

MANUAL
for the
NORTH AMERICAN
BIRD & NATURE
STUDY

QH
Guide



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**Guide to the Systematic
Use of**

**The North American
Bird and Nature Study**

A Manual and Reference

By
Harold B. Shinn, A. M.,
Instructor in Zoology, Schurz High School
Chicago
and
Gerard Alan Abbott

J. T. Bicknell
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INTRODUCTION.

In presenting the subjects of nature-study to young pupils there are several points a teacher should keep in mind. The child instinctively attributes to other creatures as much personality as he himself possesses, and a line of least resistance will follow this idea. The animals are hungry and seek a dinner; they are sleepy and seek a bed; they are lonely and seek a playmate. They have the instincts of hunger, thirst, fear, hatred, play, and mother love; some curiosity, some memory, and some reason or judgment. The thought of personality calls for a name, and besides "mother," "baby," and other family terms, every child names his household pets, the chipmunk, the squirrel, the ground hog, "Johnny Darter," and the other animals of his acquaintance. Young pupils demand this method of teaching but older ones come to regard it as meaningless. The primary teacher and the high school instructor must each find his limit.

This personification of other creatures easily gives to them mental traits which they can not possess. It has resulted in too many animal stories that are scientifically untrue, and whose falsity, discovered, disgusts the pupils with all pertaining to the subject. All nature-study fiction must be founded upon fact.

An easy and forceful way to present the facts of comparative anatomy is to imagine, and be frank to call it imagination, that nature, Mother Nature, if you please, experimented in her work shop, making various forms of fins, of wings, of feet, of beaks, of teeth, etc., etc. Older pupils eagerly tell who or what they think nature is, and this itself is a very fruitful discussion, though it must be kept in hand and guided in proper channels.

The lesson must not be too long lest the freshness of it wane and it become tiresome and dull. Yet it should not be cut short, leaving the pupil unsatisfied. While most

of the questions should be within the comprehension of the slowest pupils of the class, there should be a few suited for the bright ones, and there may well be a "nut to crack," a question to be thought about over night or until a later day.

Another phase of nature study is that, really, man has very little place in the animals' life, for only among the more wholly domesticated forms is he a necessary part of their existence. How the animal may benefit or injure man should be considered, in every case, but with younger children this topic should be only a minor one. With older classes, particularly in high school botany and zoology, economic questions should receive far more attention than they usually get. When viewed from one standpoint man is the world's greatest robber. He steals the food which the mother wheat plant has stored in the seeds for next year's children; he robs the nest of its eggs so carefully placed there; his cruelty and avarice prey upon the cow's mother love; and in countless other ways is he a despoiler; yet the cruelty of it all should be lightly touched upon. The fact is that nature formed her creatures without any consideration for man, and it is only another proof of his selfish egotism that he centers the universe in himself.

One of the great American essayists has said that we are the prisoners of our power, that we can do only those things which we are able to do, and that our horizon is the outermost boundary of our capacity. This idea is so evident to all of us that it needs scarcely any elaboration in this connection, though we are all surprised and pleased when we acquire some new means of expressing things we long wanted to say, or some idea which starts us on a long exploration in new worlds of thought.

These statements or their causes are not new in any way and no claim is made for their novelty. They are repeated here because of a conviction that many teachers lose sight of certain fundamental reasons for things and content themselves with talking prettily about superficial facts, and that among the many aids to nature-study teaching there are too many which are mere collections of

stories or pictures and too few which induce solid thinking. It shall be the aim, then, of this little book to emphasize more the causes or reasons why animals or plants are as they are and thus to enable the teacher and the class to reason from cause to effect and not to begin with the effect and stop there. For example, there seems to exist a close connection between diet and disposition, between teeth, food, and feeding habits, between disposition and capacity for protection. The better we understand these relationships the more power have we with our class and ourselves, the more efficient are we. Yet these factors are generally too difficult for very young minds and a teacher may easily overshoot the mark by undertaking things which the pupils cannot perceive. This leads to discouragement on the pupils' part and their condition then is harder to rectify than it was at first. The point is that the teacher must be a student, studying both his subject and his class.

This is the proper place to say that the chart may be used in at least two very different ways. The one best suited to pupils of younger years is to take up each picture or each plate without any connection with the others and study it as an isolated unit. Doing this there is contributed all that the children know about any one animal or plant, what they can infer about it aside from their own experience, and all that the teacher sees fit to add from outside sources of information. An entirely different method is to take up for consideration a certain phase of animal or plant life, and to follow it in its various manifestations through a series of types. For instance, what protection against enemies do various plants or various animals show? Paging over the chart this topic or any other one is taken up only briefly as each new picture comes to view. Experience teaches that each of these methods is adapted to certain ages or certain capacities, or that a change in method frequently brings freshness to work which may have grown stale both to the class and to the teacher.

Are you hungry? Hungry for what? Is it a bodily or a mental hunger? The first, if it exists, would ordi-

narily indicate that the material of former meals has been used up, and that more food is needed to prevent physical collapse, and isn't it just possible that a mental hunger is caused by the same wearing out of old ideas and that new ideas must be obtained lest the mind collapse? Doubtless we know of some starved or growing mind which is clamoring for food. How many other animals or plants get hungry, too? Is it not a wide-spread trait of life; indeed, is it not an indication that the creature is alive and not dead? But not to carry this too far let us state it then that all animals or plants must have food, and let us consider this food problem and its solution in detail in another place.

Can you move? What have you to aid in movement, legs, feet, fins, arms, wings, or flippers? Do not most other animals move, and many plants as well, and why not ask, "Why do we all move?" Is it not true that most of our movements are somehow caused by our own or another's hunger? The root thrusts out into the soil to find more food; the tendril encircles its support, pushing upward, in order that more leaves may be spread out to the sun; the deer moves to new pastures or plunges through the wood to escape its enemy's hunger.

And how do you protect yourself? Have you antlers, hoofs, claws, or what? How do plants and animals protect themselves not only against enemies but also against the varying condition of the outer world, as drought, frost, intense heat, and change of season?

We have now suggested enough to bring out the great advantage in using an outline in the study of any lesson. Such an outline the teacher may merely keep in mind, to be used or neglected, or it may be written on the blackboard to be used by the entire class. On certain days, particularly when the barometer is low, spirits are low, the class is dull and the teacher tired, such an outline placed upon the board will relieve the strain on every one, and carry the burden of the work. On other days its continued use might tend to restrict the lines of thought and to prove more of a burden than a help. For the dis-

cussion or study of an animal a very useful outline and one not overloaded with details is given here:

1. Title.
2. Form, size, color, covering.
3. Protection from enemies.
4. What it eats and how.
5. Summer and winter home.
6. Care of young.
7. Its habits and intelligence.
8. Its benefit or injury to man.

At the end of each chapter or description are to be found the initials of the author's name; in a general way the accounts of the birds were written by Gerard Alan Abbott, and all other chapters by Harold B. Shinn. However, the descriptions of charts twenty-six to thirty-five are in part revisions of the manual originally written by Dr. Albert Schneider for the previous edition of this Study.

The bibliography is purposely brief; the author of it desires to give credit to Dr. H. S. Pepoon, of the Lake View High School, Chicago, for contributing the lists of botanical books; unquestionably the bibliography is made more practical and more valuable through Dr. Pepoon's assistance. The account of insects, describing Chart 37, owes much of its accuracy and inspiration to the helpfulness of Mr. D. K. MacMillan, Field Entomologist for the College of Agriculture of the University of Illinois. Throughout the manual it has been the authors' aim not to contribute new information but to formulate a handbook for the teacher, pointing out ways in which the subjects may be presented. Should the teacher desire more information or should he question the little here given let him turn to the out-of-door book of nature, where he will find

"Tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."

H. B. S.

Chicago, Illinois. February, 1912.

CHAPTER I.

HOMES OF ANIMALS AND HOW THEY PROTECT THEMSELVES.

In telling pupils about the places where animals live, a very vivid and interesting way to present the subject is to put it as nearly as possible within each pupil's experience or observation; thus we speak of the animals' homes as being in the woods, in the fields, in the tree-tops, in burrows, and perhaps in the water. For older classes we may go a step farther and state it as though mother nature, in arranging for her animal children, had looked about for places where they might live, and that she made use of every nook and cranny for some creature. With still older pupils we may say that the animals have increased so rapidly in ages past that they have been crowded for room as well as crowded for food, and that when food has become too scarce or when a certain species has been unable to compete with others in a certain district, it has gone to some more favorable locality. Such migration has brought about the peopling of almost the entire earth's surface, so that we have animals fitted to and living in such extremes as caves, deserts, mountain-tops, and even polar regions. If the teacher will give sufficient time before hand for preparation upon the subject and will use his own original methods in presenting it, pupils of almost any age will comprehend the essential features of this struggle for existence.

A somewhat artificial method of classifying animals according to their homes would be to call those living on the earth terrestrial, those living in the tree-tops arboreal, those inhabiting the air aerial, and those living in the water aquatic or marine. Even a casual glance at each of these great types shows us that it is fitted in some peculiar way for its method of existence.

It is a very noteworthy fact and one within the observation of almost every pupil that a water animal upon the land is far more helpless than a land animal in the water. The explanation for this can be comprehended by pupils when they are asked how much a certain fish weighs at the store and how much it weighs in the water; high school classes should work out in exact figures this little problem in specific gravity. In any case the conclusion is easily arrived at that the water aids very much in sustaining the animal and that in it the creature may exist with a very much simpler organization, particularly as regards its skeleton and muscles, or else that its strength is more efficient than it would be on land. Aquatic plants are generally very limp when removed from the water, and many aquatic or marine types of animal or plant life reach enormous size.

Under the almost opposite conditions that animal, the bird, which gets its living in the air must be very light; to attain this the bones are hollow and there are spaces in the body which, when filled with heated air, act like balloons.

Home, in its higher meaning, has to do with only the animals of relatively high organization, but in the sense of its being the place where a creature likes to live, then any animal or plant has a home. Let us now consider the homes of various groups of animals. On chart 36 we have corals, starfishes and molluscs. In each case nature seems to have attempted to give the animal both protection and support by forming for it an outside skeleton. Among the corals each little polyp deposits lime in its skin near the bottom of its body. This deposition year after year causes the slow growth of a colony and the formation of the branching stem and perhaps of a reef; but no movement is possible. Nature has attempted to get similar but better results among the starfishes by embedding in the skin of each free animal small plates of lime. These permit some movement and afford excellent protection; but the movement is too slow and this plan has been abandoned. Among the molluscs the skin is soft and

slimy, and so certain portions of it excrete lime, which, in the form of one or two large solid pieces, covers the animal more or less completely or into which it may retreat. This home is successful in the way of protection but it is cumbersome, and the presence of this armour impedes activity and renders the possessor more or less insensitive to external conditions, thus dulling its senses and degenerating its intelligence.

Among the insects, chart 37, nature has made use of the shell, but has kept it soft and flexible by forming it of a thin horn-like substance, chitin, and jointing it at more or less regular intervals. This covering is very light and at the same time firm enough to afford attachment for the elaborate system of muscles used in swimming, jumping, and flying, and it does not seriously hinder sensitiveness or activity. Because, however, it is external, it hinders growth; and just as a child's clothes are incapable of growth and must be cast aside, so the insect, the spider, and the crawfish are compelled to molt.

Among the backboned animals nature has adopted an entirely different plan, putting the supporting structures deep within the body, and making the protective ones external and more adaptable to changing conditions. The external or protective skeleton may take the form of scales, of feathers, or of hair. Scales are more or less incapable of change and tend to limit the possessor to surroundings which do not change. This is readily seen to be true with the fishes and the reptiles, which are limited to temperate and tropical regions. The amphibians are almost all of small size and uniformity of structure. Living in moist localities, those members of the order which are aquatic have their feet webbed, while the toads do not. The skin of almost all of the members of this group is so moist that the oxygen of the air is readily absorbed by the blood vessels just beneath, and the carbonic acid gas of the blood readily passes outward. In this way they may be said to breathe through their skin; should it become dry this respiration would cease and the animal would die. This moist condition of the skin betrays the home of the

amphibian just as it does for the slug and the snail.

At the other extreme of home condition we find creatures living in deserts where evaporation from any moist surface must be extremely rapid; to an animal or plant it would be fatal; thus has come about the various protective coverings of plants and the dry, scaly condition of the animals' skin. This is seen particularly well among the reptiles, and in this group the scaly condition is a notable characteristic; see chart 37. The amphibian skin was totally without protection, unless we consider the acrid secretion of the toad and its warty appearance as such. But the scaly skin of the reptile lends itself more easily to various protective structures. Among the lizards the "horned toad" is particularly noticeable, because of the exaggerated scaliness which has resulted in the formation of long spines behind the head and the shorter ones all over the body. In addition to this, by means of a delicate system of muscles many of these scales can be erected, and the skin can be extended till the "toad" looks like a small balloon covered with spines, or much like a wild gooseberry. Ask any child how a bird would like to swallow a horned toad in its defensive condition.

The lizards also show a remarkable ability of changing their colors. The classic example of this is the chameleon. This variability of color is much more common among animals than is generally supposed. The common green frog shows it; even man shows it in the sun-burning of the skin, the appearance of freckles, and the blanching of the skin because of indoor habits. Another protective device shown by certain lizards is the arching outward of the windpipe in the throat region; this gives to them a terrifying appearance. They also sever their tails if necessary, and some stories say that as a last resort a blood vessel in the eye bursts and the blood is shot outward. When we consider these various protective devices of the lizards, we infer that they have a very hard time to hold their own in the animal world, and that they have had to resort to a thousand tricks to save their lives. The turtles, another group of reptiles, have formed a box-like shell by the ex-

pansion of certain bones; this can be illustrated to the class by showing them the interior of a turtle's shell. The snake may be regarded as a lizard which has lost its legs and lengthened its body. The possible reasons for this had better be passed over except with classes of high school ability. We find now by comparing the reptiles with the amphibians that we have a very much more advanced group and one better fitted to living under adverse conditions, to withstanding drought, to living in the tree-tops or in holes in the ground, to living in the water, and almost to living on the wing.

Among the birds the feathers afford free movement and a warm jacket, while their broad expanse gives great resistance to the air for flight. The bird's average body temperature is 110° F. Besides, the volume of the body is greatly increased by the plumage and the motionless or dead air among the feathers. This air is a non-conductor, of heat, thus conserving the heat of the body. Thus nature has so admirably fitted the bird for its aerial life that it is there most at home. Of course, among those birds which are not so much on the wing as the type just described, the plumage is heavy and the entire body more compact. As for the means of protection among the birds, they are discussed in the description of each type. The hair of the mammals is just as adaptable to changing conditions of life as are the feathers of the birds.

The mammals now engage the pupils' attention. Here we have the highest development of animal life, almost every member of the group being specialized. Nature prepares each little mammal for its independent existence by having it cared for within the body of the mother and by giving it the very richest of food during its babyhood, the mother's milk. Both of these features should be frankly explained to classes, the teacher stating it that they are nature's greatest achievements, and that the condition of motherhood is worthy of the deepest respect. The mammals all have most of the body covered with hair and this, being scanty or abundant, enables them to live in the widest variety of places. Thus the elephant has

its skin almost naked but very thick because hair would add to its discomfort; its thick skin protects the inner structure from injury and to some extent, at least, must check evaporation, for its home is in the torrid regions. Grading from the elephant toward the other extreme, we get a gradual thickening of the hairy coat and a thinning of the leathery hide. The giraffe, the zebra, the lion, the tiger, the hyena, and the monkeys have coarse hair but no fur. The beaver, the muskrat, the sheep and the polar bear have no more coarse hair than the tropic forms, but close to the skin they have a dense mat of fine fur to protect them from the severities of winter. The teacher is almost warranted in saying that the coarser the hair, the better is the animal fitted for life in a warm country, while the finer the fur the farther north or south of the equator or the farther up on a mountain will the animal live. This fur or hair is far more susceptible of variation than are the scales of the reptiles and the fish, the feathers of the birds, or the smooth skin of the amphibian. In the development of the hairy coat, nature seems to have tried her last and most successful achievement in clothing her creatures, for the shedding of hair is even less tax upon the animal's energy than the molting of feathers because it has no direct supply of blood vessels and nerves and is loosely attached in the skin. The inner skeleton of bones with joints between them permits unlimited and uninterrupted growth, the keenest and widest variety of sensation in the freely exposed surface, and the highest development of brain and intelligence.

A wide knowledge of animal and plant life would impress upon one the conviction that as for various means for protection the mammals are no better off than other creatures; in fact, since the brain of mammals is best developed of all and their intelligence is correspondingly high, nature has expected them to use their wits, and has not given to them as many or as remarkable devices as those given to many other creatures. Among the insects there are countless tricks of habit or color which serve for preservation of life; many molluscs, such as the sepia, the

octopus, and the squid, have sacs of "ink" for clouding the water in time of danger, or their colors, of various and varying hues, may flicker along the skin in bewildering fashion. Many aquatic creatures which live near the surface of the water are of such glassy clearness that fishes must fail to see them. Nature has also brought about by slow degrees the various odd forms and colors similar to rocks, grass, flowers, or even other animals, all for preservation of species. Even the habit of many plants of closing their flowers or leaves by night or day or during rains, and their remarkable spines, thorns, hairs, sticky surfaces and pendant blossoms are all adaptations for self-protection.

Beside all these, the adaptations of mammals seem insignificant or paltry, and one well believes that, for protection, they depend not so much on their antlers, hoofs, teeth, repulsive odors, or other small possessions as they do upon their mental faculties. Thus the opossum simulates death, or "plays possum;" the fox runs upon wagon roads and many other mammals retrace their trails or travel in creeks to lose their scent and mystify their pursuers.

The teacher may turn over the pages of the Study one after another and ask questions upon these topics, using the pictured forms with which the class is more or less personally acquainted.

1. Ask the pupils how many insects it would take to weigh a pound; how far some of them can jump or fly? What advantage is the exoskeleton?

2. How long would it take a snail to go a mile? What do the snails do in winter time? How does a snail or a clam compare in weight with an insect?

3. What kind of fish are to be found in certain kinds of places? Is it not true that each form is comparatively limited in its range?

4. Are the reptiles as a group found in polar regions; why or why not? Where do they reach their highest development or greatest size? To what extent does their activity depend upon external temperature as noticed in

the cool of the morning and the heat of mid-day?

5. How are the birds limited or restricted in their range? Can they not overcome almost any obstacle, as a mountain system, a lake or an ocean? Is it not true that the birds' real limitation is their weight or size, particularly that of the skull and brain?

6. Why do birds (chickens) molt, are the feathers faded and worn, or are they outgrown? How do chickens act at the molting season, and why? How does molting affect the hens' egg-laying habits?

7. At what seasons do domestic animals or pets shed their coat of fur, and why? How does it come off, all at once, in patches, or gradually? How is it replaced? Are bare spots exposed, why or why not? How do the old and the new coats differ in weight and in color?

8. Does a dog have hair or fur? A cat? A rabbit? A mouse? A man? What is fur and what is hair? Where are fur bearers at home, in warm or cold countries? Of what use is fur to the possessor; of what use is hair?

9. Name some furs used by man. Have some boy tell about trapping and curing skins. Have some girl tell about seal hunting and the manufacture of seal skin garments; also about imitations of seal skin.

10. Investigate the seal controversy between the United States and Great Britain.

H. B. S.

CHAPTER II.

THE RELATION BETWEEN ANIMALS' FEET AND THEIR HABITS.

While almost every boy and girl realizes that the habits of animals must depend very closely upon their feet, yet few children are able to explain definitely just how this relationship obtains. A wide-awake boy may at first regard as trivial any discussion of this subject, but if he can be induced to give it serious attention and to follow it for some little distance, he will soon find that it challenges his ability to think and becomes just as interesting a problem in its solution as any of those riddles or puzzles in which children delight.

It has been said that the inside of an animal tells us what sort of an animal it is or to what group it belongs, while the outside tells us where it has been; thus the internal structure of the whale proclaims it a mammal while the possession of fins instead of limbs betrays it a water-living creature. In this way can the children by the simple process of deduction study the various charts one after another and make quite accurate statements about the homes of the various forms. Turning from page to page of the Study various forms or adaptations of the leg and foot are illustrated. Some of the insects on chart 37 have the front feet projecting sidewise for grasping the support, while the hind legs are elongated backward for jumping. Others, as certain bugs and beetles, have the hind legs oar-like for swimming or the front legs broad and heavy for digging; thus are disclosed the secrets of the insect's habits.

The fishes, plate 38, have membranes of skin lifted out from the surface of the body upon supporting rays of bone or cartilage. We call them fins and they may serve as keels, propellers, balancers, or rudders. The structure

and the position of these fins vary greatly, just as do the habits of the fishes. A young frog or tadpole, is essentially a fish, but when the development of the fore and hind legs proclaim a change from a water to a land life, fins become useless and fingers and toes necessary. In that high group of vertebrates, the mammals, where the possession of fingers and toes is an almost rigid rule, certain forms, as the whale, have gone back to a water life and therefore, while not entirely losing the fingers and toes, they have covered them with flesh; the characteristic structure of the feet is present though not seen from the outside.

All of the frog family, Amphibia, have only four toes on the front foot and are entirely devoid of nails. Among the reptiles the land life has become so fixed that the number five applies to the digits of hand and foot almost without exception, and the nails have become developed, among the tree climbing lizards to a remarkable extent. The snake, however, has lost its feet, though some of the bones of the leg are still present internally.

The birds have long since ceased to rely upon their feet for great support and the result has been that one of the toes has disappeared, leaving four, and in some cases even the fourth toe has disappeared. The hand has become covered with feathers and fingers are useless, though three rudimentary fingers are still to be found in the wing, a statement which the pupils of the class will corroborate the next time a fowl is served upon the table at home. There is still existing, however, in the jungle forest at the mouth of the Orinoco river in South America an "old fashioned" bird, Hoactzin, the young of which has a tiny thumb which is used as a hook in climbing about through the trees.

Among mammals the hands and feet are generally present and well developed but there may be great extremes in their structure and use; thus a digger or burrower will have large forefeet and strong claws while the hind feet may remain small; for example, see the mole. A climber will have long sharp claws which may be with-

drawn for protection or extended for grasping the tree trunk; even some of the toes may be pushed backward or sidewise to give a greater extension of the foot; for examples, see the squirrel and the bat. A flyer will have a membrane of skin stretched between the fingers and toes, as the bat, or such a membrane stretched between the fore and hind feet, as the flying squirrel.

A form light in weight, as the deer, will have slender legs while a heavy one will have legs shaped like pillars, as the elephant. A life in the ground necessitates short legs; a life in the open, long ones. Speed is attained when the animal rises upon the tips of its toes like a boy who sprints, and even greater speed is attained when the animal can run upon one toe instead of five. Thus among the ungulates, chart 39, there are various forms of feet illustrated, from those of the elephant where five toes are present to the horse where only one remains. Some of the more patent relationships between feet and habits are these:

A webbed foot indicates aquatic habits, a naked foot or one unwebbed indicates little or no recourse to the water; a foot partially webbed betokens a mode of life partially aquatic, as for instance, the wading habit. A feathered fore limb is used for flight. An expansion of the skin between the arms and legs also indicates flight or attempts to fly. Short, stocky legs indicate a bulky body and probably considerable strength of limb but comparatively slow locomotion. Long legs are generally accompanied by a rather slender body and they are most often used for speed or for elevation of the body above the supporting surface; speed is indicated by few toes, strength of bone, and smoothness of outline; elevation alone is usually indicated by slightness or slenderness of limb. Along with the short stout legs and heavy body there naturally go shortness of neck and bulkiness of head, while the lengthening of the leg so that the body is lifted away from the ground necessitates a corresponding lengthening of the neck and face in order that the mouth may be once more brought close to the food materials.

The form of the foot is dependent upon the character of the supporting surface. If this surface be yielding like that of water or soft mud there must be a greater expansion of foot or fin, while if the supporting material be very hard there is a corresponding decrease in the expanded surface of the hand and foot. Thus, on page 39 for example, the broad foot of the camel would indicate soft or yielding ground like that of mud or sand. The hairiness of the leg, however, practically eliminates the possibility of life in marshy or in muddy surroundings, for it would be almost impossible for an animal with hairy legs to maintain itself successfully in such a place. This statement is well illustrated also by the smooth legged marsh-dwelling or wading birds. The lengthening of the legs generally indicates some speed in a fairly open country such as plain or prairie. It often indicates, however, a home in the water or in tall grass where the body itself is lifted above entanglements.

Now whenever the legs have lifted the animal far above the ground the neck must be elongated so that the mouth can be brought to the objects furnishing food material, hence a long leg would indicate a long neck and head. However, the head may become large and heavy, like that of the elephant, so that it cannot be supported with ease at the end of a long neck; then the neck remains short while the face itself is elongated in the form of a muzzle like that of the moose, the deer, the cow and the horse, or in the form of a flexible trunk, like that of the elephant.

It frequently happens that in order to attain unusual length of limb certain of the bones which ordinarily are short are lengthened, as illustrated on chart 47. In the illustration of the horse's foot, the metatarsal bones, which in man form the instep, are so elongated that the ankle joint, here number 3, is so far from the ground and so near to the body that it is ordinarily called the knee. The knee itself is imbedded in the skin surrounding the body proper. In the horse's front leg the joint ordinarily called the knee is that called in man's hand the wrist. In this instance, namely the horse, the slender bones at the

extremities of the limb are excessively developed while the ones near the body are shortened and enlarged for greater strength and more perfect control. Without going any farther into the details of comparative anatomy among the vertebrates enough has been said to indicate a profitable line of inquiry for the older pupils.

Among the vertebrates the customary or original number of fingers and toes is five, but for various reasons of necessity or ease of action this number suffers wide variations. Certain of the carnivora, such as the cat and the dog, have four toes on one foot and five on the other. Almost all of the ungulates have fewer toes than five, the minimum number being one, as indicated in the horse. Here the middle finger and toe is the one in use, the nail having become the hoof while all of the other fingers and toes save two have failed to develop. These two are called splints and are indicated in the illustration plate 46, or may be seen in the skeleton of a horse.

The variations among the mammals, particularly the ungulates, are discussed in direct connection with each of the forms where they occur, as with even and odd toed ungulates. Where very great strength and firm support are called for the foot remains flat on the ground and the full complement of toes persists. For great speed, many toes are in the way and one strong toe or finger answers the purpose so well that all the others are degenerated. Children know well that they can run faster upon their toes than they can if the entire foot is placed flat upon the ground. Nature discovered this a very long time ago and she has shaped her creatures accordingly. The animal which walks upon its flat foot is said to be *plantigrade* while the one using only the tips of the toes is called *digitigrade*.

At this point in the work it would be well to turn over the pages of the Study, noticing particularly the form of the leg and foot of various well marked types and, without giving the names of the animals, to ask the pupils to tell something of the animal's probable habits, such as walking, running, swimming or wading, or its probable life in

open country or in burrows. Concealing the upper portion of the bodies in the pictures, the teacher may ask various pupils to observe the form of the limbs and to make statements regarding the probable size and form of the bodies supported by these limbs. Then removing the guard permit the children to find out how accurate the previous statement or "scientific guess" has been. Or the teacher may outline upon the board various forms of legs, giving them numbers. Then he may ask the pupils to describe the probable habits of animals possessing such legs and possibly to name definite forms. If the foot of the animal indicates great size then must the form travel considerable distances in order to obtain food for the up-building of that size; thus the elephant is accustomed to move many miles upon its foraging expeditions. It is, in truth, a very successful traveler and has always been, for the ancestors of the modern elephant, while they originated in Africa, penetrated the farthestmost portions of the earth to which access by land was possible; their remains are found in all continents except Australia. They passed from their place of origin northeastward across Asia, through Siberia into Alaska, southward through Mexico and central America even to Patagonia.

The great amount of food necessary to sustain a body of considerable size is only to be found in regions where the sunlight penetrates to the ground so that herbage is luxuriant, while smaller dimensions of the body and, of course, smaller feet indicates a less amount of food, a sufficient quantity of which can be obtained in somewhat wooded, shady or bleak surroundings. Therefore, can one conclude quite accurately the home and habits of an animal from the study of its feet. One should be somewhat cautious in carrying things too far, however, for nature did not develop her creatures according to man-made schemes and any of his rules are subject to frequent or wide exception. A more accurate means of drawing inferences regarding the habits of animals is the study of the teeth; something of this work is explained in another chapter. 1. Of the feet illustrated on chart 46, which one

is best fitted to support a large body; which one indicates the greatest speed; which one indicates a home on marshy or yielding ground where a broad supporting surface is required, and which indicates life in an open country upon firm unyielding turf? 2. Which one has toe-nails fitted for scratching, or perhaps for clinging to the bark of trees in climbing? 3. On which foot do the toe-nails seem best arranged in order that they can be drawn back when not in use and thus kept sharp for scratching or climbing, and upon which foot are toe-nails more movable? 4. Which animal, then, conceals its toe-nails and pads its feet so that its tread is noiseless and it steals upon its prey unheard, and on which foot are the toe-nails so placed as to leave definite imprints in the trail or to cause a scratching sound upon hard surfaces? In the latter case does the animal seem to rely upon stealth or upon great strength for its protection? 5. What kind of toes and toe-nails would a digging animal have for its work? What kind has a climbing animal, such as the squirrel or the lizard?

H. B. S.

CHAPTER III.

THE RELATION BETWEEN THE TEETH, THE DIET, AND THE DISPOSITION.

Reference to chart 46 brings out noteworthy differences in the teeth of various animals. Those of the reptile are, with the exception of the poison fangs, of uniform size and structure. There are no teeth especially fitted for grinding food, for biting or tearing it, and we conclude that the food is probably not well masticated in the mouth but is swallowed whole. These teeth point backward and we infer that the food is perhaps living material, which struggles to escape from the mouth of the captor. The average boy knows that the two lower jaw bones are not rigidly joined but that they work forward and backward alternately so that the food is soon brought into the mouth and swallowed. Such an arrangement is necessary, for the food is alive and struggling and the reptile has no feet or other organs for grasping or holding the prey.

The teeth of the dog show three or four distinct variations. Those projecting forward apparently would be used for biting, the head being held straight out; next come the large teeth, relatively enormous, which seem to be fitted for piercing or for tearing. Immediately behind these are three or four low but solid teeth, apparently useful for heavy work, possibly for gnawing a bone; and at the very back are two or three broad heavy teeth which would crush a hard object, perhaps the bone.

The teeth of the monkey, orang-outang, are quite similar to those of the dog. Particularly prominent are the canines, which are almost long enough to merit the nickname of "tusks." The ape shows a tooth arrangement and structure intermediate between that of the monkey and of the man, and we infer that its food was more nearly

like that of the human being. Each of these sets of teeth indicates at least some flesh, or animal food, in the diet.

Radically opposed to them are the tooth arrangements of the horse and the rodent. In each of these the grinding teeth, with their broad surfaces and heavy bases, are present, and the front teeth or incisors also. But there is a mysterious gap between the teeth in front and those behind; this might be caused by the extreme projection of the mouth to enable the animal to browse upon the grass of the plain, or it might be caused by the total repression of the canines. In either event it is apparent that animal food plays little part in the creature's diet.

The picture of the beaver's skull illustrates very well how teeth are kept sharp. The front edge is of hard enamel and the back portion is of softer dentine; no matter how much the teeth are used, the softer portion wears away first so that there is always a sharp edge projecting, supported by the sloping dentine behind. The teeth are chisels and are self-sharpening. Ask the pupils of the class to rub their tongues against their own front teeth and find out whether or not there is even a little of this chisel formation in the incisors. If the teacher should be so fortunate as to have a living rodent in the class-room, a rabbit or some other pet, the pupils will be very much surprised when they push back the creature's lips and see these teeth projecting. Also ask some boy what use is made of the empty place in the horse's mouth when the bridle is put on; ask him, too, how far back the horse's mouth opens, and which teeth are exposed when the horse opens his mouth. Ask some farmer lad whether or not the upper and lower incisors enable the horse to crop the pasture closely, and whether the cow has the same teeth and has the same effect upon the pasture; how much is usually charged for pasturing a horse, and how much for a cow, and why there is any difference in the rates. Have the pupils of the class examine the mouths of any animals they may be able to experiment upon to determine which teeth are absent or present. Ask them by a series of questions to what extent the kinds of teeth present influ-

ence the kinds of food which the animal eats. On chart 48 the skull of the ant-eater illustrates a very extreme type and the absence of teeth indicates some remarkable habit of feeding; find out what this is. (See *Armadillo*, chart 43).

Now, to follow this line of thought still further, is it not true that herbivorous animals are generally timid, while animals that use meat exclusively are of a more aggressive character? As long as a puppy is fed upon potatoes he is a perfectly lovely baby dog, but when meat is added to his plate of food there occurs in his disposition a noticeable change. It would seem that the meat contains certain substances which act directly upon the nervous system and bring about the more vigorous or passionate characteristics which we have all observed in some animals.

Putting two and two together, then, we are quite warranted in reasoning from cause to effect. In making a study of the animal's teeth and concluding as to its disposition, show any wide-awake class the skull and ask them to tell you to what kind of an animal it belonged. What kind of an animal it was, where it may have lived, what it ate, who its enemies were, and what sort of a character or disposition it may have had. High school classes will be very glad to take such a topic as this and study it very fully. Certain pupils of the class would be anxious to take some special topic and work it up. Advanced or special topics would deal with the cause and the use of tusks, the cause and presence of the canine teeth in animals of one sex only in one or both jaws, and the comparison of people who are vegetarians exclusively and those who include meat in their diet as to their powers of endurance in physical test, and their working capacities, both mental and physical. Is it true that great size indicates great efficiency? Which is the more successful animal, the vegetarian elephant or the carnivorous lion, the deer or the wolf, the rabbit or the weasel?

H. B. S.

CHAPTER IV.

THE COLORS OF ANIMALS.

Before explaining the details of the coloring of animals and its relation to surroundings, the teacher should understand to what color is due. The light upon which we almost entirely depend reaches us from the sun, and it is well known that a ray of sunlight which appears white is in reality composed of at least three primary colors from which are derived all the known tints and shades. If this ray of sunlight is reflected from a surface in its entirety, without any of its constituents being subtracted from it, it will reach the human eye as full white light, and we say that the surface from which it is reflected is white. If, however, all of the light is absorbed by this surface, then none is reflected to the human eye and we say that the surface is black; if all of the light except the green is absorbed and the green is reflected to the eye, we call the surface green. It must be true, then, that the colors in nature are almost entirely due to light reflected from surfaces, and it remains to be determined what causes such reflection.

In many cases, notably the sheen and iridescence of the feathers on birds, on many beetles and other insects, and upon numerous other animals, the color or the appearance of color is due entirely to very delicate markings upon the waxy or metallic surface. Colors caused in this way are generally spoken of as metallic.

In the vast majority of cases, on the other hand, color is due to some chemical substance imbedded in the skin which has the power to absorb certain colors and reflect others. The absence of this pigment has a very close connection with exposure to sun light. Animals and plants living in dark places, such as cellars and caves, are noticeably pale or white, while those exposed to the brightest

sun rays have the most vivid colorings. In many cases there may exist in the skin more than one set of pigment bodies and these may be exposed or concealed as occasion demands. Such pigment bodies may be like small sacks, some of them being pressed to the outer surface of the skin and flattened, while the others are withdrawn inward. Examples of this action are seen in the common tree-toad and in many of the lizards.

Since pigment is a chemical substance it is easy to understand that it is quite variable, that it may be changed rather easily; thus we understand why it is that colors sometimes are changed with the seasons, with the advent and passing of the breeding season, and with an animal's change from one locality to another. Without going into all the details and the countless examples of oddities in color we may here enumerate some of the various uses which it may serve its possessor.

1. Protection through harmony with the surroundings.
2. Protection by marked contrast with the surroundings and warning of the possessor's dangerous nature.
3. Imitation; protection by imitating a dangerous form.
4. Special markings distinguishing other individuals; special recognition marks distinguishing other animals of the same kind.
5. Attractive colors used by one of the sexes to attract the mate.
6. Colors which apparently serve no useful purpose but exist perhaps because of crossing of animals of different colors or the sudden appearance of a freak or sport.

Examples of general protection through harmony are so abundant that they need hardly be enumerated. The mud turtle is brown, the snail is brown, and the jack "rabbit" on the snow-covered prairie is white and on the dry grass of the summer is gray. The pickerel in water weeds is green; the female oriole in her nest in the tree-top is green, though her mate is brilliantly tinted. The grasshopper is similar to the stem to which he clings and the stripes down his body appear as bands of sunlight. The

common bull frog will within a comparatively short time change from a very vivid yellowish green to a dull dark green or bronze. The chipmunk and gopher very closely resemble alternating bands of light and shadow in the grass. These examples serve to illustrate the classification and any wide-awake boy or girl will contribute from his own observation illustrations without number.

Contrast is obtained in various ways. On a yellow surface large splotches of black appear and very often these black markings are rendered more vivid by a fine edging of white which seems to lift them up from the surface. Animals which exhibit such contrasting colors are generally poisonous, inedible or offensive in some way. The poisonous lizard of the southwestern desert, the gila monster, is one such, the skunk with his vivid white stripes is another, and many of the insects, particularly the butterflies and moths, are other examples of the same principle. Perhaps this place is the proper one in which to explain the baffling coloration of the zebra. Mr. A. Radcliffe Dugmore is authority for the statement that as the zebra stands broadside before one and some little distance away the stripes are very vivid, but as the animal changes position these colors disappear and the animal seems to fade from view. The effect is to arouse great uncertainty as to the animal's exact whereabouts at any certain time.

Imitative colors generally are found on animals which are themselves harmless. By a long and slow series of changes these colors have become marked, probably because the members of a family who possessed them were shunned and those which did not possess them were attacked. The walking-stick insect imitates very accurately a twig, sometimes a brown one, often a green one. Many spiders with small bodies and long legs closely resemble a small enlargement on a yellow stem. The dead-leaf butterfly, chart 37, is an almost exact reproduction of the dull brown leaf when the striking colors on the upper sides of the wings are concealed as the wings are folded.

Special recognition marks are abundant. The rabbit

in his flight wig-wags a signal with the white surface on the under side of his stubby tail. The Canada goose has a broad band of white on the under side of its black neck which is supposed to be a signal as the first bird of the flock quickly rises in flight; many other birds exhibit markings on various parts of the body which would serve the same purpose. Almost all of the insects, particularly the butterflies and moths, have markings which apparently would serve no other purpose than to distinguish them from insects of other kinds. There is scarcely any need of multiplying examples here. The instructor may almost invariably find some good use for any noticeable color that an animal may possess.

Sex markings are often very striking, noticeably so among the birds and mammals. Inasmuch as the female bird takes upon herself the incubation of the eggs and the care of the young, so that the welfare of the family depends upon her safety, it is manifestly right that her colors be protective. It rests with the males then, to make themselves attractive so that mates will be chosen and the species continue from generation to generation. Hence it is that the male bird is the strongly marked one. The male cardinal is for the most part a vivid scarlet, while the female is a quiet green. The oriole, the black bird, the blue bird and many others show a striking difference between sexes in this respect. Among the mammals sex markings may be present in one form or the other, though it generally is true that the male is the more strongly marked of the two. Among the insects such markings are present but more obscure.

Examples of an apparently useless color are occasionally met with. Such would be the markings on certain molluscan shells (plate 36), and the parti-colors on certain domestic animals, as the cow and the dog.

The teacher will do well to page through the chart, and ask the class to explain the color of various forms. As a rule the bird pictures show sex markings the best. The teacher should choose beforehand those illustrations which he is to use in the class discussion.

H. B. S.

CHAPTER V.

MOTHER LOVE AND BABYHOOD; THE DEVELOPMENT OF ANIMALS.

It is a striking fact that this subject appeals most strongly to the girls of a class, and yet that there is something in it which appeals to the finer instincts of the roughest boy. If the teacher is skillful it can be presented to a class without exciting the ridicule of any pupil. It is a subject which should be included in the training of every boy and girl, appealing as it does to the higher faculties of the mind, for if it is not presented and these faculties are not developed in any other way, the children go out not so very much better than little beasts. Among the numerous questions which can be answered in almost every school room, from the Study, from specimens which the pupils will bring in, or from the pupils' experience, are the following:

How many different kinds of nests have the pupils seen, and where were they made? Do only the birds make nests? What is a home? Is the snail's house his home? Where do baby snails come from; young crawfish? How does the mother rabbit provide a nest for her young; the old house cat? How soon after a little chicken hatches does it begin to eat? What did the little chicken eat before it hatched; what has become of the yolk and the white of the egg? How does the shell of a turtle's egg differ from that of a bird's egg, and why are they different? Is it true that mother snakes swallow their babies when danger is at hand? How does the old hen call her chickens; how many different kinds of calls has she, and what do they indicate?

Such a list might be indefinitely prolonged, and if the teacher is fatigued from trying to think of his own questions, let him keep a note book from year to year, recording those asked by the pupils.

ECHINODERMS.

To follow the order of the charts we shall begin away back among those low animals, the star-fishes, chart 36. The mother star-fish has so little intelligence that it seems as though nature could not entrust to her the care of children, and we find that the multitudes of eggs develop in the open water of the ocean, and are devoured in great quantities by other animals, or are washed great distances by the waves and tide. Out of this great number of eggs probably only a few ever survive to reach maturity, for it seems that star-fishes are not increasing very fast but are just about holding their own in numbers from century to century.

MOLLUSCS.

In the group of molluscs the mother has more intelligence or is better fitted to care for her off-spring. The mother clam retains a few thousand eggs within her shell for a considerable time; here the little ones absorb nutriment from her body until they are large enough to provide for themselves, when they are ejected into the surrounding water. The snails, both the land and the water forms, produce just a few eggs at a time and these are comparatively large and protected each with a shell. These eggs are secreted in various places, sometimes under the bark of a rotting log, sometimes enclosed in a jelly-like mass which is fastened to some water-weed to keep it from being washed away, and sometimes inclosed in capsules or glued into a collar like ribbon which is largely composed of sand. This sand tends to make the whole mass inedible, and it is very likely that in almost every other case the mass is rendered distasteful by some means. The eggs and the development of the various molluscs are very interesting subjects for study, but they should be taken up for the most part in higher classes.

INSECTS.

Among the insects, chart 37, there is the widest range of intelligence and a correspondingly wide diversity in the

care given to the eggs of the coming generation. The insects of the grasshopper group, *Orthoptera*, are among the most primitive of them all and here, of course, the mother takes the least care of her children. The eggs are laid in packets, sometimes in the ground, sometimes under the bark of a young twig, and the young are left to look after themselves. However, there are not a great many eggs, they are comparatively large, and each contains enough food material to set the little insect well along his way to maturity.

The true bugs, *Hemiptera*, are for the most part very similar to the *Orthoptera* in their breeding habits, though there are notable exceptions. Certain of the water bugs place the eggs on the back of one of the parents, where they stick fast until they hatch.

Among the beetles, *Coleoptera*, we have various interesting manifestations of the maternal instinct. Mother tumble bug prevails upon her spouse to help her bury some decaying matter in which the eggs are to be laid and which will furnish food for the developing young. The teacher is urged to discover this story and to tell it to the class, for it is one of the most enchanting little tales in all the insect lore. The weevils, too, are very careful of the coming generation. In the south the cotton boll weevil deposits her egg in the heart of a growing cotton boll where her grub-like baby will find an abundance of rich food. This serves excellently for her but it brings sad disaster to the man who had expected a bumper crop of cotton. Out in the woods another weevil lays her egg in the growing nut of some tree and here the little fellow finds a cozy home till the next season or until you or I may break the nut at Christmas time. Still another weevil punctures the skin of a plum or some other fruit and in the hole deposits an egg. She then slits the skin near by and the sap, oozing out of the plum, flows into the first hole, dries and effectually seals it up. Thus the mother weevil makes sure that her little one cannot escape from the maturing fruit and that his future is provided for. Her instinct is a very beautiful one from the ethical point of view, but

a very fiendish one as seen by the farmer. The teacher should look up in government and state publications the economical importance of the various weevils, although each child has had sufficient experience with a wormy nut or fruit to enable him to appreciate the ravages of these insects. Among the beetle family the development of the young is often very slow and the little fellows, always hungry, eat incredible amounts of food. Every farmer's boy knows something of the various grubs and cut-worms which are the larvae of beetles, and he knows of their effects upon the orchard, the garden or the field. He also knows how some of these beetle larvae bore their way through timber, riddling it with holes and decreasing its value to an enormous extent.

In the group including the flies and mosquitoes, *Diptera*, the young are generally called grubs, and while their hunger is not so disastrous to us, the adult forms are very often of great importance, particularly for sanitary reasons. In higher classes there are abundant questions for the pupils to work out, but in all classes the effects of the fly and mosquito upon public health and cleanliness should be taken up.

In the group containing the butterflies and moths, *Lepidoptera*, mother love is not particularly well developed. The eggs, comparatively few in number and large in size, are placed where the young will find proper food; this seems to be all that the mother does for her off-spring. The young we generally call caterpillars; their enormous appetites are well known. There is no plant raised by man which is exempt from their attacks.

Coming now to the bees, the wasps, and the ants, *Hymenoptera*, we find a very high development of motherhood. The wasp burries her egg in an underground tunnel or one that she bores in some twig, or perhaps she makes an elaborate nest of paper or mud to shelter the coming family. Wherever this nest may be she puts into it along with the egg some juicy morsel upon which the baby may feast. Most frequently this is a spider which she has stung so as to render it inactive but not dead. How much

better it must be for the little wasp to feast upon fresh meat than upon meat which is dead and well decayed. The mother wasp has solved the cold storage problem in her own way and better than man has done. The bee feeds her young upon plant material, predigested and highly nutritious. This is the pollen of flowers or bee jelly which has been regurgitated from the crop of the young worker bees, which like the older children in the human family, act as nurses for the babies. The baby ants are provided for in very much the same way as the larval bees. The story of the home life of the bees and the ants and the wasps is so elaborate that it needs separate attention though used here to emphasize the statement that a true mother does love her children.

FISHES.

Passing onward into the group of animals all of whom have backbones, we find almost as much diversity in the care given to the children as there was in the preceding orders. Some of the fishes, chart 38, lay their eggs in horny capsules which are abandoned to the mercy of the waves. Others, such as the sunfish and the stickleback, form shallow nests in the sand or globular nests of water-weeds, wherein the eggs are hatched and the young reared. Wherever among the fishes we find this home instinct it is generally the male parent which is the guardian of the home; sometimes he has to protect it from cruel attacks of the mother. The remarkable instinct of the salmon impels it to undertake its wonderful journey of perhaps a thousand miles from the ocean to the mountain brook where, in the cool shallow water, the eggs are laid. It is said that the salmon gives up its life for this, for most of the adult fishes never survive to reach the ocean again. The story of the developing eel is in place in this connection and should be explained to classes where their interests warrant it. So great and so rapid are the changes in the sea, that for many years the story was unknown and the ancients believed that eels arose from the mud of the sea bottom or from the slime of fishes. Young eels, when

two years old, ascend the rivers and live until full grown in fresh water streams and lakes. Then, journeying down to the sea and descending to great depths, they soon reach sexual maturity, and return to shallow water near the mouths of rivers to lay their eggs. The adults soon die, never entering fresh water again. "The number of young produced has been estimated, in the case of an eel thirty-two inches long, to be 10,700,000."

AMPHIBIA.

The mother love of the frog prompts her in the early spring to lay her eggs out in the pond far enough below the surface that should the pond begin to dry up the eggs would still be under water. A little imagination will picture a strange sight. Some morning, long before the sun is up and while there is still ice around the edge of the open water, the frogs and toads and land salamanders come hopping and leaping toward the pond. They swim out and dive in search of some twig or support firm enough to hold the egg mass. This trooping to the pond is like the exodus of the children in Browning's poem of the "Piper;" in fact, we may supply the piper's character in some old bull frog. Any country boy or girl will tell the class about frog eggs, toad eggs, and pollywogs; this material is easily kept and observed in the class room.

REPTILES.

The reptiles have abandoned almost entirely the water life, and their eggs are generally laid in some secluded nook, buried in the sand. Since these eggs are exposed to a certain amount of evaporation and must be supported, they are inclosed in a leathery shell which protects them sufficiently against all emergencies. There are a few reptiles that retain the eggs in the mother's body, and hatch them there, so that the young are well developed when they make their appearance in life's arena. The exceptions to the egg laying habit are hardly worth individual attention. An animal which lays eggs is said to be *oviparous*; one which brings forth its young alive, *viviparous*.

BIRDS.

Among the birds mother love reaches such a very high development that it puts many human mothers to shame. Some birds, such as the bob-white and prairie chicken, make their nests upon the ground. In almost every case this nest is designed for the comfort of the young and yet it is so much like the surrounding turf or thicket that it readily escapes notice. The mother is often very wary and approaches her nest in a round-about way.

Questions and Experiments. Ask any boy or girl if it is easy to find the nest of a turkey, a duck, or a chicken; let him relate or write as a story his experience in this. Ask him if the chances are better for the race of birds to maintain its numbers if, in a ground nest, there are many eggs or few. What enemies or marauders would be likely to pillage such a nest? How do quails sit at night? How does the mother defend her young?

Take a number of eggs, say a dozen, and place them in a circle with their small ends inward and again with the small ends outward; make a similar nest of marbles or balls. Place an egg on the floor and try to roll it to see whether it will roll straight away from the nest or would tend to roll in the nest. By means of these experiments and by reference to the nest pictures in the Study, chart 25, bring out nature's wonderful adaptation in the egg's form and structure. High school classes should be given a laboratory exercise on the internal structure of an egg and the development of the chick. A careful teacher can do a certain amount of this with even a kindergarten class. Using a fresh and a boiled egg, demonstrate the white, and yolk, the limy shell, the outer and the inner shell membranes, the membrane around the yolk, and the ropy structures, chalazae, which keep the yolk in the center of the egg. Point out the air space between the outer and inner shell membranes at the large end, and the small white germ-disk which, if present, always floats on the yolk and is destined to develop into the baby chicken. Ask or explain how the little chicken breathes while it is hatching, why it does not dry up in the air, why the mother

hen turns the eggs while hatching them, what the albuminous material and the yolk-fat is for, and what use man makes of an object which nature intended to be used for an entirely different purpose.

A long and an interesting exercise may be developed upon the egg, the pupils being requested to bring to class all the different kinds of domestic eggs they can obtain. Pupils should be able to identify these eggs; they should be allowed to measure eggs of various kinds and sizes, either weighing them by the dozen or counting the number in a pound. Something of the time and methods of hatching should be taken up, and perhaps a setting hen may be borrowed to set in the class room or laboratory. In connection with this the teacher can get the children to make crates out of old boxes, to bring some of their chickens to school, and a "poultry show" may be conducted for a day or two. The roosters may make more noise than the teacher but the children will enjoy the change, and such an exercise occasionally inserted in school work often serves to put new life into a dull subject and it might possibly be the salvation of a fossil teacher. Pupils should be discouraged in their collection of the eggs of wild birds; perhaps the best way to do this is to ignore them entirely as objects of study, but the various ways in which mother birds manifest their love for their children should be taken up at least in part.

MAMMALS.

The parental care exercised by mammals is hardly as interesting as that of some of the lower animals; in almost every case the young are reared in some sort of a retreat, such as a den, a lair, a cave, a burrow or a "house," where they spend much of their time in sleep. They are always nourished upon the mother's milk, and in order to demonstrate the completeness of this material as an article of food, teachers of higher classes could well test cow's milk for its fat, protein, sugar, and mineral content. Such experiments are described in "Physiology for the Laboratory," an inexpensive little manual written by

Bertha M. Brown and published by Ginn & Company. The origin of the word *Mammal* will be made in pressive if the teacher will write it upon the board and then erase the last letter; he should explain that the new word is an old word, that no matter what language the parents speak, the human babies all speak the same, and that this old word is found in the most ancient languages and literature.

Without having them explained previously the pupils should be asked questions to bring out the following general relationships. Large animals produce few young; small animals many. If the young are immediately abandoned and no further care is given them, so that they have small chance of reaching maturity, there must be many of them else the race will die out. If there are many eggs or young, each is small and poorly developed at birth or hatching, so that subsequent development is long and slow; if the eggs are large the young will be relatively well developed and able to care for themselves.

H. B. S.

CHAPTER VI.

PARASITIC AND SOCIAL HABITS OF ANIMALS.

While the matter to be discussed in this connection may not be within the comprehension of very young children yet it is easily grasped by pupils of high school age. It may be presented to them in connection with, or entirely separate form, the Study. As stated in the introduction, matter of this character which is understood by the teacher gives him just so much more confidence in himself and so much more efficiency in the class room. The subject is far too vast for comprehensive treatment in one chapter of a small book, and for further investigation the teacher must seek the answer to his questions in psychology and advanced biology.

The writer has found a very graphic way of demonstrating the main issue of animal association to be by means of a blackboard diagram. A horizontal line is drawn across the middle of the board and from it a series of steps are constructed upward and another series downward, while the horizontal line is named "solitary individual." The downward steps represent degeneration from the solitary existence to one of complete parasitism, such as that of the tapeworm, which has lost almost all of its bodily structures except the reproductive system; should this disappear the species becomes extinct, therefore this system persists. In the development of the parasitic habit there are many gradations, the principal ones of which may be indicated as steps in the downward stairway. Perhaps the first movement toward parasitism and degeneration is when the animal becomes parasitic at times and still retains its individuality. Such a form is the louse, the flea, and the "blood-sucker," or leach. These are external to the host and may depart from it at their pleasure to seek a living elsewhere. The next step is illustrated by the mite

and tick, animals which become more or less permanently attached to the host, frequently burying themselves in its flesh. Such forms frequently lose their organs of movement from place to place, probably because these organs are no longer used. The succeeding stages are illustrated by the young forms of clams and certain fishes, by the gap-worm of the chicken, the liver fluke of the sheep, and hosts of other parasitic forms.

Gradually, as the animal ceases to move, its organs of movement disappear and with them much of the muscular system. Permanence of position implies little or no use of the eyes and other sense organs, and they disappear. At this time the organs of sensation and control disappear also. This of course means the profound degeneration of the nervous system and the brain and the loss of mentality. As the creature becomes totally parasitic it is able to absorb its food predigested from the tissues of its host and so the organs of digestion, circulation, and respiration degenerate and are lost. In the extreme condition the form loses all other structures except those of reproduction, becoming merely an "egg machine." Among the innumerable forms of parasites, there are those causing various sicknesses of man and beast, some of which may be mentioned here though they must be left to the reader for further investigation. There is the sheep tick, the cattle tick, the various fleas and lice, the warbles and bot flies, the hook worm, the tape worm, trichina, gap worm, ascarides, the worms infesting birds and fishes, the horse hair snake, and the germs of disease, some of those at present challenging medical skill being infantile paralysis, sleeping sickness, surra, and kala-azar.

Going back to our horizontal line, the solitary individual which supplies all of its own needs, protects itself, secures its own food, and cares for its own young, we may mount the steps upward toward a perfect socialism in which the burdens of existence are shared equally by the members of a group. On the first step we may place those animals which occasionally gather together for various purposes such as protection, migration, or securing

food. Coming down to us from early English, each with its own meaning, but applying to this habit, are such words as school, bevy, pack, drove, herd, and flock. Upon the steps immediately following the first are to be placed those animal forms which, while they preserve their own identity, yet maintain constant association with each other to the extent of living in villages or rookeries, as the prairie dog, the beaver, the seal, the rook, the penguin and many others. In mounting the stairway, forms are soon reached which maintain a certain division or allotment of the work. Thus certain of the bees, wasps, and ants are merely workers, short-lived and sterile, while there exists one or more members of the family or group which can live from one season to another, produce eggs, and insure the perpetuation of the species. The climax or top of the stairway is reached in the honey bee and the ant, forms which maintain enormous colonies and perfect government. The story of such a community is beautifully described by Mrs. Comstock in "The Ways of the Six-Footed." In the development of the colony, the colony as a whole improves in efficiency and perfection of work, but each individual loses individuality and becomes, as it were, merely a cog in a great machine. Perhaps this is the reason why man does not adjust himself readily to communal life. He cherishes carefully his individuality or independence of thought and action.

BEES.

In certain localities the work of bees in honey production is of greater importance than in flower pollination, though it may be explained to classes by the use of those figures described in the section on "Pollination." To some whose knowledge of the work of bees is meagre, this story is of captivating interest. The worker-bee is a female, whose only duty in life is the securing and preparation of honey or comb, tasks for which she is fitted in many ways. One of her three pair of legs is very broad and somewhat saucer-shaped so that she is enabled to pack upon and

around these legs the waxy pollen which she gathers from the flowers. Her mouth is tube-like and with it she sucks up the nectar or sweet sap which the flowers have secreted to induce her to pay them a visit. When she has filled her crop, or honey stomach, with this nectar and has loaded her "pollen-baskets" full, she returns to the hive, there regurgitating the nectar into the cells of the comb, while other bees remove from her legs the golden store of pollen. Some of this pollen is fed to the young bees which are to become workers; the rest is eaten by other members of the swarm only to be "sweated" out after digestion in the form of tiny drops of wax, which are removed from the body and molded into beeswax and comb. The nectar, at first too thin, is evaporated, or "boiled down," by bees which gather in certain parts of the hive and rapidly buzz their wings in order to create currents of air across the mouths of the cells. This commotion also heats the interior of the hive and further aids in the evaporation of the nectar. The final outcome of all this prodigious labor is the thick honey and the beautiful comb with its delicate coating of wax at the mouth of each cell.

Such, in a brief way, is the story of the work of the bee. The further details of the multitude of fascinating happenings within bee-hive or bee tree cannot be explained here. Any bee-keeper will answer questions or reference may be had to books upon the subject. An ingenious boy with some experience can make an observation hive with glass sides through which the work of the bees can be observed by the class, or such a hive can be purchased for about \$5.00 from some of the firms which manufacture them.

ANTS.

In human affairs there is no family or community which approaches in the smoothness and completeness of its management that of a colony of ants. In one way the colony may be regarded as a family, for it may have developed from one mother, but it would be more near the truth to describe a nest of ants as a city, for there exists

in the colony individuals of several kinds. There are males and females, whose sole duty it is to insure the perpetuation of the race; there may be soldiers for guard or protection, workers for excavation or construction, nurses for the care of the young, and other forms which vary among the ants of different species. The story of the ants has engaged the attention of poets and philosophers from the very earliest times and there exists today many accounts of their work; the most complete and closely scientific one of these is Wheeler's "Ants," but the most readable book for young children or teachers of young children is Dr. McCook's "Nature's Craftsmen." The latter, while dealing particularly with the activities of various ant communities, takes up as well the work of wasps, bees, and several other insect forms.

In Texas and the southwest there exist certain agricultural ants which harvest the seeds of certain wild grasses and store them in underground chambers for use the ensuing season. For some distance around the ant hill no grass is allowed to grow except that which will furnish the kind of seed desired. In this way, while the ants do not plant the seed of these grasses, yet they harvest the crop with great skill. In many cases, these seeds are prevented from germinating during storage by having the embryo or germinating area bitten out; should the stored grain become damp or moldy, it is carried to the open air in the sunny days and allowed to dry. In other cases, grain in the storage chamber is allowed to ferment, and the alcohol formed is drunk by the ants until they manifest all the characteristics of finebriety, such as staggering, falling and sleeping by the wayside. Again, some ants allow to develop upon the stored grain in their underground chambers certain molds which are esteemed by them just as highly as a man esteems his mushrooms, cellar-grown.

In the honey ants of Colorado and the southwest certain members of the community gorge themselves with food until their abdomens become distended with digested sweetness; thus they act as reservoirs to which other members of the community may come for refreshment. Cer-

tain other ants in tropical regions divide themselves into two groups, one of which mounts a tree, cuts off the leaves, and drops them to the ground. Here the ants of the second group cut them into bits and carry them off, piece by piece, to the storage chambers of the nest. Other ants are slave-makers, obtaining their slaves by raiding the nests of other species and carrying off the undeveloped young. Certain of these slave-makers have become so dependent upon their slaves that they are fed, kept clean, and carried from place to place by them, the slave-makers dying when the slaves are removed.

Many other ants carefully tend certain small insects known as aphids, at night driving them into chambers which have been hollowed out within twigs or stems, by day driving them out upon the twigs and leaves; by winter sheltering them in underground chambers, and during the advancing spring carrying them from one food plant to another. Aphids are thus protected and suck the sap from the plant while the ants, by stroking the bodies of the aphids, induce them to secrete through pores in the skin minute drops of a sweet liquid called "honey dew." This stroking has been called "milking;" the aphids, "ant cattle;" and the honey dew is the ants' "national dish."

The number of ants in any one community is incredible. It increases rapidly during the summer, for there may exist in a community many queen-mothers, each of whom lays hundreds or thousands of eggs a day. At times overcrowding or lack of food induces the colony or part of it to stray out on long expeditions to new pastures, and many observers have seen troops of them marching in single file or in solid columns many feet broad. Often they prevent the progress of other animals, and occasionally as they march down a railroad track, they impede the movement of trains. Almost everybody has seen emerging from the nests, usually near sundown, hosts of winged forms which are the young males and females setting off on their wedding journeys or flights to found new colonies elsewhere.

Children should be encouraged to investigate the do-

ings of ants and the various kinds of them present in every locality. High school classes and those of upper grades would be interested in the formation and conduct of artificial ant nests, descriptions of which can be obtained in various books of reference.

H. B. S.

CHAPTER VII.

INTER-RELATIONSHIPS BETWEEN PLANTS AND ANIMALS.

Food.

Perhaps the first question which any child will ask, unconsciously allying himself with the great animal world as opposed to the plant, is, "Is it good to eat?" There is hardly any portion of any plant which is not edible to some animal. On chart 32 are pictured various plants which are used by man in this way. Commercial ginger is a product of the East, though various wild forms of it grow elsewhere and have been used by man for a long time. Most of the other spices are also eastern products, though they are now being grown in various parts of the world, and the United States Department of Agriculture is attempting to introduce their culture into the United States. Most of them belong to one single group of plants, the *Cruciferae*, a group which furnishes us the cabbage, the radish, and a large number of other edible plants. The subject of the commercial importance of the *Cruciferae* is well worth the investigation of high school classes, and their chemical peculiarities interest all pupils. The industries connected with the production of coffee and of cane sugar are equally important and may be used to advantage in almost any class. On charts 33 and 34 are pictured various plant products which are directly edible, all of them being fruits and owing their production more or less directly to the work of insects, as is explained in chapter VIII. Any one of these fruits, nuts, or grains may be taken up individually for careful work or they may be discussed in a very general way with classes of younger years. In addition to these plant products pictured in the Study there are many others, used by man and beast, such as green leaves, young twigs, roots, and tubers.

Nature forms so many seeds that there is always an over-production of plants upon which the animal population of the world is a check or balance. If the plants were all to grow they would soon choke themselves out, using up the available food in the soil and the carbon dioxide in the air. The earth would become a desert. In another paragraph will be explained the peculiar function of animals in preserving the constant equilibrium of life upon the earth through the rotation of the atmospheric gases.

Since plants derive their materials for growth from the soil and air, a thing which animals are unable to do, then animals are directly dependent upon plants for their existence from age to age. Animals which feed directly upon plants are called *herbivorous*, those which feed upon other animals, *carnivorous*, and those which eat both animal and plant tissue, *omnivorous*. The relation of the diet to the teeth is explained in chapter III.

PROTECTION AND LURE OF PLANTS.

Now, since it is the object of every plant to produce seeds so that the species may continue, it is evident that many plants must preserve themselves against the untimely attack of animals until the seed has been matured. Almost any botany will explain in detail the various devices by which plants do protect themselves. A few well known examples are thorns or spines upon the stems and leaves, stiff, cutting edges and stinging hairs, tough bark, underground storage of food, and offensive odors and flavors. Even the fact that most fruits are sour or bitter until the time when the seed is ripe seems to indicate an effort at protection of the still growing seed, and the sudden chemical changes occurring in the fruit at the time of maturity as a passive invitation to the animal to come, eat the fruit, and carry the seed away. On the other hand many animals, chiefly insects, are lured to plants by means of odors, colors, and the secretion of sweet juices, most frequently that pollination may occur but sometimes, as in the case of the pitcher plant and other carnivorous forms, in order that the animal may be ensnared, destroyed, and its tissues dissolved and absorbed as food.

SEED DISPERSAL.

The ways in which seeds may be scattered and the plants spread throughout wide stretches of territory has been hinted at in the preceding paragraph, namely, by means of the edible fruit. Ask the class how many of them ever planted a peach stone, an orange, an apple, or a cherry seed, and whether they planted it underneath the tree where it was grown. This is an excellent illustration of the acts of untold numbers of other animals, and examples of such seed dispersal may be drawn from the class. The same question may be asked with reference to chart 34 in connection with the various nuts and corn and all other grains; also the use of burrs in seed dispersal. Through animal agencies such fruits and seeds have been scattered throughout the world. The importance of these to man is incalculable, and here we open up a very large field of research or library reading by enterprising pupils.

ACTION OF BACTERIA.

During its period of life and activity every animal and plant withdraws from the soil or from other sources of supply food materials which then become embodied in that animal or plant; after a fashion, this material becomes locked away in a strong box and is out of circulation, like a miser's hoard. Should this continue without its being returned to circulation, very soon all food of plant and animal life would be used up and life would cease. Much of the material for the formation of wood, of sugar, of starch, of fat, of bone, and of brain; all the oxygen, hydrogen, nitrogen, carbon, and other food elements would be stored in the bodies of animals and plants, and the woods and fields, oceans and lakes, would be littered and clogged with carcasses. In order to prevent such a catastrophe and to keep the relatively scant supply of food materials in use year after year and age after age, the Creator or Nature, has provided for their release and restoration through the action of bacteria, both those causing decay and those utilizing the nitrogen of the air. The moment succeeding death, and even during life, the small micro-

scopic plants, bacteria, are working toward the destruction of tissue, some doing one thing, some another, but all busy like a gang of workers on a building. The final effect is the complete disintegration of tissue into primitive substances which are now available for use again. The newly famous soil bacteria, found generally in close association with clover and other leguminous plants, are only a means of placing within the grasp of other plants the nitrogen which has escaped into the air and which is so very difficult to regain.

USE AND RELEASE OF CARBON DIOXIDE.

The last topic in connection with this subject and from the standpoint of pure science the most important one, is what is often called the carbon dioxide cycle, or, to put it more simply, the way in which carbon dioxide is given off by animals, is used by plants, eaten by animals, and again exhaled by them. Before undertaking this explanation it might be well to state very definitely that plants do not breathe carbon dioxide, or carbonic acid gas. The statement that they do has been made so frequently and taught to so many pupils that the notion has become very wide spread. Scarcely anyone believes today that the sun moves about the earth every twenty-four hours; why should we teach that plants breathe carbon dioxide?

All living tissues, plant and animal, use oxygen, "breathe it," if you please, while plants under the stimulus of sunlight take in carbon dioxide from the atmosphere and by means of a complicated series of changes form of it their tissues and certain storage substances such as starch and sugar. Along comes the animal and devours the plant and the carbon dioxide in its material form. Plant tissue digested and changed becomes animal tissue, and upon the addition of oxygen which the animal has obtained in breathing, this tissue breaks down, or breaks up, into its original constituents, which are now waste products to be disposed of by the animal. The carbon dioxide is given off in breathing, blown by the wind over field and moor, where it is again taken up by the growing

vegetation to be made over once more into tissue or storage product. In terms of chemistry, we may say that the plant combines 6 particles of carbon dioxide, CO_2 , with 6 particles of water, H_2O , forming one particle of sugar, $\text{C}_6\text{H}_{12}\text{O}_6$, and setting free 12 particles of oxygen ($6 \text{CO}_2 + 6 \text{H}_2\text{O} = \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2$). This oxygen, set free into the atmosphere, is that breathed by all living creatures, plant and animal; it is carried by winds over city and country, mountain and valley, ocean and lake. The ox and the elephant get it, the wheat plant and the palm use it, and, absorbed into raindrop and wave, it reaches the minnow and deep sea fish. The animal, in its activity, combines with one particle of sugar the 12 particles of oxygen, forming 6 particles of carbon dioxide and 6 particles of water. In fact, the animal just reverses the plant process, so that what the plant had made the animal unmakes, the materials thus being ready to be used again. The omission of either one would cause the other to cease. These processes have probably gone on since the beginning of life upon the earth and will continue as long as life exists.

While this subject, the carbon dioxide cycle, is rarely touched upon in nature-study work, an alert teacher will want to understand it and some classes will be able to grasp the subject at least in a simple way. It surely is one of the most vital questions in all science and the better the teacher understands it and similar topics, the more efficient will that teacher be and the more satisfaction will he get from life.

To summarize our statements we may say that animals and plants depend upon each other for food, that plants protect themselves from animals or entice them, that they depend upon them for the dispersal of their seeds, and that there exists between the two a very intimate relation as regards the use and release of food elements, and the use and liberation of carbonic acid gas and oxygen in the air.

H. B. S.

CHAPTER VIII.

INSECTS AND THE POLLINATION OF FLOWERS.

While this subject is usually confined to discussions in high school classes there is no valid reason why it need be dealt with so briefly and so far along in the child's education. Even a kindergartner knows, perhaps by bitter experience, that bees visit dandelion blossoms, and a wide-awake youngster will ask the question, "Why?" If the parent has not already given the secret away, the teacher should tell the story in simple language to every child of every age, though, of course, it need not be repeated every year to every child. It is hardly possible to estimate in dollars or millions of dollars the importance of insect pollination. It goes without saying that the high school instructor will explain to his classes, both those in zoology and those in botany, some of the intricacies of pollination and of insect structures. Reference to chart 33 will demonstrate to any class that many fruits are edible and that in almost every climate there are particular types peculiar to that climate; in the tropics, for example, there grow the pineapple, the banana, and the orange; in colder regions there develop the apple and the grape. In each locality the teacher will find numerous examples to further demonstrate this topic.

Even a child in the primary grade can grasp the statement that when the yellow dust from the flower is blown by the wind or carried by an insect to another flower, the second may then begin to grow and form an object which enlarges and finally becomes the apple, the peach, the cherry, the grape, the strawberry, or the tomato, and that if this dust should not reach the second flower it would not grow and the fruit, which we all like so well, would not be formed. Therefore the child should be glad to have the bee make her round of morning calls, for each of them

means something for him to eat later on. A little practical arithmetic can be developed from this subject by counting the number of blossoms on a twig and calculating the number of twigs on a branch and on the tree and thus the amount of fruit to come, even to the extent of estimating the size of the crop and the financial returns and the net proceeds after all expenses are paid; or the number of visits the bee would make in a given length of time and the distance she might travel. Numerous practical questions may be formulated in this way and the old dry subject of arithmetic will take on new life when it comes so close to the pupil.

On chart 34 the parts of several varieties of flowers are shown and any teacher, by the use of either plain or colored chalk, can reproduce the essential structures on the black-board and explain sufficiently well the general facts of pollination. The flower of the quince is so similar to that of the apple, the pear, the peach, the cherry, and many others that it may be used and even the name changed to fit the case. Figure 2 may be copied with only one structure of each kind shown, pollen as yellow dust sketched upon number 3 and carried across by a dotted line to number 5. Number 7 may be sketched in an inverted position or right side up and the development of the fleshy portion of the fruit explained as being brought about by the stimulus gained from the pollen grain. The plant merely wanted to form the seed; the development of the fleshy part was an afterthought, it being a bait for some animal which, by carrying away this fruit, would perhaps scatter the seed in new ground.

All of this work is essentially a part of botany but it is not fair to teach zoology and the subject of insects without introducing the matter. The notion has become entirely too prevalent that all insects are bugs and that every bug is a menace and should be killed on sight. It is only fair to the beneficial insects to give "them a show," and to explain their great work in nature and for man in bringing about pollination and the ultimate formation of fruits of nearly every kind. Almost all of those fruits pictured

on chart 34 owe their existence to the work of insects. Therefore the beauties of nature and the welfare of man depend very largely upon some of those winged creatures which we so ruthlessly destroy.

H. B. S.

CHAPTER IX.

THE WAYS IN WHICH ANIMALS MAY BENEFIT OR INJURE MAN.

Space here is too limited to take up this subject as completely as some might desire; besides, it is not the intention to make of this manual a text-book but rather to make it explanatory to the Study. It is very manifest that many animals are injurious and many of them beneficial to mankind in many widely different ways. They are beneficial inasmuch as they may furnish him with food, with materials for clothing, and for experimental work upon diseases; and they may be used as beasts of burden, for the preparation of many articles of commerce, as companions, and sources of pleasure. On the other hand, they may be man's direct enemies as beasts of prey or as the sources of diseases among man and domestic animals; they may destroy his crops, his food, his clothing, or they may ruin manufactured products. In discussing any one type of animal or plant its economic importance should be and is mentioned in the manual.

Flesh of almost any animal is used for human food, generally with the exception of most animals wholly carnivorous. Then too, the eggs of birds and fishes are eaten and various portions of the body, not directly edible, are sometimes so prepared as to enter into man's diet. An example of this is gelatine, prepared from horns and hoofs and cartilaginous portions of the cow's body. There is the milk of various mammals and the products of it, such as butter and cheese. Among the articles of clothing obtained from animal sources are wool, fur, silk, feathers, leather and skins of various kinds.

Current investigation into the cause and treatment of various diseases make use of such animals as the guinea pig, the rat, the mouse, and the monkey. Among the

diseases at present (1912) under investigation are measles, scarlet fever, and infantile paralysis, to discover the cause and cure of any one of which the lives of many animals are justly sacrificed. The beasts of burden are, as a rule, of large size, great strength and endurance, and of tractable disposition; these conditions are best met with among the hoofed animals. The commercial products obtained from animals are numerous. Among them may be mentioned cochineal, guin lac, Spanish fly, isinglass, glue, cod liver oil, and ivory. The companions of man need hardly be enumerated; there are even the singing insects, used in Japan as we use house birds, besides the pets of all kinds in or about almost every home.

Beasts of prey, carnivorous mammals, are growing of less relative importance. There are many pests and enemies of other kinds, principally insects. Diseases which are communicated to man by the insects, come to him largely through those forms which attack the person or infest the house. They are bedbugs, lice, ticks, flies, fleas, and mosquitoes. We are just beginning to learn the vast importance of insect infection, particularly in the tropics, where the bubonic plague and the sleeping sickness are unconquered enemies, and where domestic animals are so liable to disease. The hookworm disease has proven a fearful scourge to the South, but the light of science has revealed the wonderful life history of the hookworm and pronounced the death sentence.

Those animals which injure man's crops of all kinds are, for the most part, insects, though rodents are also active. Forms which injure commercial products are again, for the most part, insects, such as the meal worm, the cockroach, the cricket, the white ant, and the clothes moth. To treat of insect injury to various crops would require a volume.

H. B. S.

CHAPTER X.

BOOKS OF REFERENCE.

In installing a public or a private library there are two factors which should determine the choice of the books; the first is the mental equipment of the reader who is to use them; the second, the amount of money available for their purchase. The teacher of nature-study will find his best books out of doors, but just as children need some training in observation, even so does the teacher need new ideas, new modes of expression, and often, if the work grows stale, new inspiration.

One of the best books for teachers' use is "A Handbook of Nature Study," by Anna B. Comstock (Comstock Publishing Co., Ithaca, N. Y.) This work is a mine of information and inspiration, treating as it does the insects, birds, fishes, mammals, flowers, trees, fruits, the essentials of earth and weather study, and some little astronomy. It contains about 950 pages and 1000 illustrations.

The following list is what the writer would advise for a small library to which pupils have access for reference; a much more complete bibliography is contained in the "Handbook" mentioned above.

TITLE	AUTHOR	PUBLISHER
American Natural History . . .	<i>Hornaday</i>	Scribner
American Animals	<i>Stone and Cram</i>	Doubleday-Page
Citizen Bird	<i>Wright</i>	Macmillans
Color Key to North American Birds	<i>Chapman</i>	Appleton
Bird Homes	<i>Dugmore</i>	Doubleday-Page
Nature's Craftsmen	<i>McCook</i>	Harpers
Shells of Land and Water . . .	<i>Baker</i>	Mountjoy
American Insects	<i>Kellogg</i>	Holt
Fish Stories	<i>Holder & Jordan</i>	Holt
American Trees	<i>Hough</i>	Hough
Bacteria Yeasts and Molds . .	<i>Conn</i>	Ginn
Nature's Garden	<i>Blanchan</i>	Doubleday-Page
The Moss Book	<i>Marshall</i>	Doubleday-Page
The Mushroom Book	<i>Marshall</i>	Doubleday-Page
The Tree Book	<i>Rogers</i>	Doubleday-Page

For a more complete library, some of the volumes of which could be loaned to pupils for home reading, the following are well adapted:

MAMMALS.

TITLE	AUTHOR	PUBLISHER
Animals of the World	<i>Knight & Jenks</i>	Stokes
Black Beauty	<i>Sewell</i>	Lothrop
Bob, Son of Battle	<i>Oliphant</i>	McClure-Phillips
Campfires of a Naturalist ...	<i>Edwards</i>	Appleton
Domesticated Animals	<i>Shaler</i>	Scribner
Kindred of the Wild	<i>Roberts</i>	Page
Little Beasts of Field and Wood	<i>Cram</i>	Small-Maynard
Squirrels and Other Fur Bear- ers	<i>Burroughs</i>	Houghton-Mifflin
Wild Life in Orchard and Field	<i>Ingersoll</i>	Harpers
Types and Breeds of Domesti- cated Animals	<i>Plumb</i>	Ginn

BIRDS.

Bird Life	<i>Chapman</i>	Appleton
Birds in Their Relation to Man	<i>Weed & Dearborn</i> ..	Lippincott
Story of the Birds	<i>Baskett</i>	Appleton
Campfires and Cruises of an Ornithologist	<i>Chapman</i>	Appleton
Birds of Song and Story ...	<i>Grinnell</i>	Mountjoy
Birds of Lakeside and Prairie	<i>Clark</i>	Mountjoy
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OTHER ANIMALS.

American Food and Game Fishes	<i>Jordan & Everman</i>	Doubleday-Page
The Story of the Fishes	<i>Baskett</i>	Appleton
Ant Communities	<i>McCook</i>	Harpers
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How to Keep Bees	<i>Comstock</i>	Doubleday-Page
Insect Life	<i>Comstock</i>	Appleton
Nature Biographies	<i>Weed</i>	Doubleday-Page
The House-Fly	<i>Howard</i>	Stokes
The Spinner Family	<i>Patterson</i>	McClurg
Wasps, Social and Solitary ...	<i>Peckham</i> ..	Houghton-Mifflin
Ways of the Six-Footed	<i>Comstock</i>	Ginn

PLANTS.

TITLE	AUTHOR	PUBLISHER
A Flower Guide	<i>Reed</i>	Reed
Familiar Trees	<i>Mathews</i>	Appleton
First Studies of Plant Life	<i>Atkinson</i>	Ginn
Glimpses of the Plant World	<i>Bergen</i>	Ginn
Lessons with Plants	<i>Bailey</i>	Macmillans
Little Flower People	<i>Hale</i>	Ginn
Minute Marvels of Nature	<i>Ward</i>	Crowell
Nature Study	<i>Overton</i>	American Book Co.
Nature Study on the Farm	<i>Keffer</i>	American Book Co.
Plants and Their Children	<i>Dana</i>	American Book Co.
Seed Dispersal	<i>Beal</i>	Ginn
Seed Travelers	<i>Weed</i>	Ginn
Ten Common Trees	<i>Stokes</i>	American Book Co.
The Oak	<i>Weed</i>	Appleton
The Soul in a Flower	<i>Hubbard</i>	McClurg
Wild Nature Wooded and Won	<i>Tuck</i>	Stokes

H. B. S.

H. S. P.

CHAPTER XI.

THE BIRD.

The author takes the liberty of quoting the following from Frank M. Chapman's excellent book, entitled "Bird Life."

"When compared with other animals, birds are found to occupy second place in the scale of life. They stand between mammals and reptiles and are more nearly related to the latter. Certain extinct birds so clearly connect living birds with reptiles that the two classes are sometimes placed in one group. The characteristics that distinguish birds from mammals on the one hand and from reptiles on the other are more apparent than real; thus, flight, the most striking of a bird's gifts, is shared by bats among mammals. Egg laying is a habit of most reptiles and of three mammals, but incubation by one or both parents is peculiar to birds. Birds breathe more rapidly than either mammals or reptiles. Mammals and reptiles both have teeth, a characteristic possessed by no living bird.

There is good evidence for the belief that birds have descended through reptilian ancestors. This evidence consists of the remains of fossil birds. The wanderings of most mammals must necessarily be limited but the winged creatures of to-day are very generally distributed. This is due not alone to their power of flight, but to their adaptability to varying conditions of life. The economic value of birds to mankind lies in the service they render in preventing the undue increase of insects and small rodents, in destroying the seeds of harmful plants, and in acting as scavengers. Birds digest their food so rapidly that it is difficult to estimate from the contents of a bird's stomach at a given time how much it eats during the day.

Birds will appeal to many of us more strongly through

their songs or vocal powers. After learning a bird's language, you experience an increased feeling of comradeship with it. You may even share its emotions as you learn the significance of its song.

Birds' wings are primarily a means of locomotion, but they are also used as weapons, as musical instruments, in expressing emotion, and they are sometimes the site of sexual adornment. As the feet share with the wings the responsibility of locomotion, there is often a close relation between these organs. In a small short-winged terrestrial species like quails, grouse and rails, they have well developed feet, but such aerial creatures as swifts, swallows and humming-birds have small weak feet.

The relations of a bird's color to its nest and habits is a complex subject. Any attempt at its explanation should be based on so exact a knowledge of the facts in the case, that I can not too strongly emphasize here the necessity for observations in the field. Only a close study of the living bird will justify in advancing theories to account for its coloration. Many explanations have been offered to account for certain colorings and markings of birds, but often, I fear, without adequate knowledge of the bird's habits. I shall speak of only four classes of colors; they are *protective*, *deceptive*, *recognition*, and *sexual colors*.

Protective colors render a bird inconspicuous in order that it may escape its enemies. Deceptive colors render it inconspicuous in order that it may more easily approach its prey.

Deceptive, or, as some naturalists term it, "aggressive" coloration is perhaps best illustrated by common flycatchers. Although these birds live in and about trees, they are as a rule quietly attired in olive-gray. Insects are therefore more likely to come within snapping distance than if these birds were conspicuously colored.

Recognition, signaling or directive colors have, with more or less reason, been made to include many different types of markings. Such are the white outer tail feathers of juncos, vesper sparrows, meadowlarks, and towhees.

Other birds possess certain bright colors on the wing or outer tail coverts which are noticeable only when the bird is flying. Markings of this kind are supposed to aid birds in recognizing others of their kind; their special use is to keep the individuals of a family or flock together so that when one starts the others may readily follow.

The term "protective coloration" has lately received fresh significance from the studies of Mr. Abbot H. Thayer. Mr. Thayer proves conclusively that protective coloration lies not so much in an animal's resemblance in color to its surroundings as in its gradation of color. Thus he points to the fact that as a rule animals are darker above than below—that is, those parts receiving the most light are darkest and the parts receiving the least light are lightest.

Selected by G. A. A.

CHAPTER XII.

MIGRATION OF BIRDS.

Prof. Wells W. Cooke of the Biological Survey, National Department of Agriculture, has prepared considerable material regarding this subject. He says: "The migration of birds has long been considered an unfathomable mystery. Late investigations have furnished abundant data on the when and where of migration and solved many of its puzzles. No correct understanding of bird migration is possible until it is considered as a voluntary evolution.

"All migratory movements must have begun with slight changes of location. From this short migration benefit accrued to individuals or their posterity. Migration became a fixed habit and the distance covered gradually increased as each succeeding extension proved advantageous. It may also be said that food supplies en route have been the determining factor in the choosing of one course in preference to another, and not the distance from one feeding place to the next.

"The location of plenty or suitable provender having been ascertained, the birds pay no attention to the length of a single flight required to reach it. The shape of the land areas in the northern portion of North America has tended to create variations in migratory movements. If the whole area from Brazil to Canada were a plain with the general characteristics of the middle section of the Mississippi valley, the study of bird migration would lose much of its fascination.

"The different courses taken by the birds to get along or over this intervening inhospitable region are almost as numerous as the families that traverse them. The birds west of the Alleghany mountains move southwest in the plain approximately parallel with the seacoast and

most keep this same direction across the Gulf and eastern Mexico. The birds of the Mississippi valley go southward to and over the Gulf. The birds between the Missouri river and the edge of the plain and those of Canada west of the Rocky mountains, move southeast and south until they join the others in their passage of the Gulf.

"It is not to be supposed that these long flights over the waters can occur without casualties, and not the smallest of the perils arise from the beacons which man has erected along the coast to insure his own safety. 'Last night I could have filled a mail sack with the bodies of little warblers which killed themselves, striking against my light,' writes the keeper of the Fowney Rocks Light House in southern Florida. Lighthouses are scattered every few miles along more than 3,000 miles of our coast line. A red light or rapidly flashing one repels the birds, but a steady white light piercing the storm often proves irresistible. In whatever different direction the birds approach they veer to windward and then flying against the wind seek the object of their infatuation. A large number do not strike with sufficient force to injure them, but like great moths they flutter in and out of the light's rays and finally settle on the platform or framework to await the abatement of the storm or the coming of sufficient daylight to enable them once more to orient themselves.

"How migrating birds find their way over the widespread regions lying between their winter and summer homes has always been one of the mystifying problems of the migration student. A favorite theory of the past and one still claiming many advocates is that river plains and mountain chains form fine highways along which the birds travel in the spring and which are easily recognized on the return trip.

"The golden plover takes a straight course across the ocean and if the weather is favorable makes actually 2,400 miles without pausing to rest. This species nests along the Arctic coast of North America and as soon as the young are old enough to care for themselves, fall migra-

tion is begun by a trip to the Labrador coast where the plover often feeds for several weeks on the abundant native fruits. A short trip across the Gulf of St. Lawrence brings it to Nova Scotia, the starting point for its extraordinary ocean flight, due south to the coast of South America.

"The arctic terns have more hours of daylight and sunlight than any other animals on the globe. At their most northern nesting site the midnight sun has already appeared before their arrival, and it never stops during their entire stay at the breeding grounds. During two months of their sojourn in the Antarctic they do not see a sunset and for the rest of the time the sun dips only a little way below the horizon. The birds therefore have twenty-four hours of daylight for at least eight months in the year and during the other four have considerably more daylight than darkness. The arctic tern is proven the world's migration champion. It deserves its title of Arctic for it nests as far north as land has been discovered, that is as far north as the bird can find anything stable on which to construct its nest. Indeed, so arctic are the conditions under which it breeds that the first nest found by man in this region, only $7\frac{1}{2}$ degrees from the pole, contained a downy chick surrounded with a wall of newly fallen snow that had been scooped out of the nest by the parent. When the young are fully grown the entire family leaves the Arctic region and several months later they are found skirting the edge of the Antarctic continent. What their track is over that 11,000 miles of intervening space no one knows.

"Arctic terns arrive in the far north about June 15th and leave about August 25th, thus stopping fourteen weeks at the nesting site. They probably spend a few weeks longer in the winter than in the summer home, and if so this leaves them scarcely twenty weeks for the long trip of 22,000 miles. Not less than 150 miles in a straight line must be their daily task, and this is undoubtedly greatly increased by their zigzag twistings and turnings in pursuit of food.

"The robin's average temperature of migration is 35 degrees Fahrenheit, that is it puts in its appearance when the snow begins to melt and streams to open, but before vegetation has made any start. The number of miles traveled over varies greatly in different parts of the migration journey. Robins arrive in northern Illinois as early as the middle of February, and it is the first of March before spring and the robins cross northern Missouri where the temperature is milder than that of the Great Lakes region. They fly slow and average not to exceed fifteen miles a day.

"The migration route of the bobolink shows how these birds which summer in southern Canada and the northern portions of the United States travel 2,300 miles, and the migration lines converge in the southward movement of the bobolink, so that those from both eastern and western North America converge toward the rice fields of the South. After gorging themselves to repletion, they press on towards their Brazilian winter abode. The case of the bobolink is a fitting close to this article because it is to us at the present time the manner of evolution of a new migration route. The bobolink being a lover of damp meadows was formerly driven out of its western haunts because of the intervening arid regions. With the advent of irrigation and the bringing of large areas under cultivation little colonies of bobolinks are beginning to appear here and there almost to the Pacific coast." These birds instead of migrating via the Mexican route leave the United States as they enter through Florida.

Science can not yet account for the fact that in migration most diurnal birds migrate at night; birds of weak, short flight may become birds of strong, long flight; birds ordinarily of low flight may attain to great height.

Two observers at the University of Illinois made observations a few years ago regarding the height at which birds fly during the migrations. These gentlemen watched the moon's disk at night through small telescopes placed some distance apart, and from the different paths of these birds which were seen approaching against

the moon from the two situations it was possible to compute the height and direction of flight of each bird.

This experiment has not only enabled the scientists to estimate the height at which the birds fly but to find with much greater accuracy than has been possible heretofore the speed of their flight. The average height at which migrating birds fly is not more than 1,500 feet from the ground. The speed at which they travel appears to be greater than has of late years been believed to be the case. The maximum speed of the birds observed varied from eighty to one hundred thirty miles an hour. These records were made, however, when the birds were flying with the wind.

Selected by G. A. A.

CHAPTER XIII.

HOW TO STUDY THE BIRDS.

All temperate North America is inhabited twelve months of the year by bird-life. Our feathered friends exist in greater numbers than most people suppose. It is desirable to commence observations about the first of the year, for in January, though our bird ranks are greatly depleted, the hardy winter residents may be observed with ease as there is little foliage to obstruct the view. Inexhaustible patience together with "bulldog persistence" is productive of the best results. We may become botanists or geologists with the realization that the object of our search exists in a given locality, but the bird student finds a constant change taking place in his field. The bird he desires most to examine becomes elusive and keeps him constantly on the alert.

A good pair of field or opera glasses are valuable in determining the colors or markings on various birds but our chief aim is to learn how and when to look for a given variety.

One need not absent himself from inhabited sections in order to become acquainted with the common and many of the rarer birds. The average 200-acre farm with its natural timber and lake or water-course is an ideal spot for bird study. Birds, in their efforts to avoid their natural enemies, such as prowling mammals, birds of prey and reptiles, are inclined to seek rather than avoid the domains of man. You may be surprised to learn how many birds visit dooryards and orchards in the rural districts annually. Many are only migrants on their way to and from a more northerly latitude, but from ten to twenty-five varieties are common about our dwellings, orchards and pastures.

Let the bird student who is to acquire a knowledge of bird life by observation, avoid the society of other

persons when going "birding." It may be interesting to have human companionship and some one to share with you in the finds you hope to make. Usually the naturalist never lacks companionship simply because he is without the company of other people. To the lover of the prairies, water-courses and timber lands—for such he must be to successfully acquaint himself with our feathered creatures—there can be no longing for companionship. The nodding flowers, swaying branches, rippling brooks and breezy meadows all convey messages of their own.

Let us take for example a given area not to exceed fifty miles from Lake Michigan anywhere within an imaginary line drawn from a point in southwestern Michigan through northern Indiana and Illinois, thence northward into southeastern Wisconsin. During January we have with us such birds as the downy woodpecker, white-breasted nuthatch and chickadee, which are fond of each other's company and quite likely to be observed together, moving about the trees in our door-yards, orchards or woodlands. The noisy bluejays are more or less in evidence and the ever cautious crow visits the pastures and corn fields.

The evening grosbeak, pine grosbeak, Bohemian waxwing, redpoll, white-winged and red crossbills are at this season of the year wintering about the Great Lakes region, feeding in coniferous trees or on orchard buds, and often searching for wild berries and unpicked fruit. A few of our hardy goldfinches may be in the vicinity, and slate-colored juncos in company with tree sparrows are feeding on seeds in the weedy patches. In the open areas the Lapland and Smith's longspurs are busily feeding and calling to each other in their mellow notes. Horned larks, shore larks and snowflakes are to be seen on the prairies or often about the barnyards when snow is deep.

Old hollow trees afford ample protection for the screech, barred and horned owls. Occasionally a stray snowy owl from the far north is encountered. The hardy raven

often reaches a latitude as far south as Illinois and Indiana, and at this time of the year, is apt to be feeding along the shores of the Lake looking for aquatic and land animals.

The northern shrike haunts the hedges and parks occupied by our quarrelsome English sparrow or busy tree sparrow. Bands of Canada geese are living on the open water. They collect there during the daytime and just before sunset we see or hear them moving in regular V-shaped flocks to the fields where they feed by night.

The grouse are very companionable at this season of the year, the prairie chickens and bob-whites congregate in immense flocks. The little bob-whites seek shelter along the rail fences or about the underbrush, while the prairie chickens frequent the fields. The ruffed grouse spends the day feeding on the ground, roosting by night in the trees where no prowling animal may disturb.

Herring and ring-billed gulls hover over the rivers and along the shores of the lake looking for fish or decayed animal matter.

February brings no particular change except that other winter visitors may have arrived or some friends departed. Our true winter ducks are fishing on the open water. They are the old squaw, golden-eye, white-winged scoter, American and red-breasted mergansers.

During the last ten days of February the great horned owl may be observed sitting upon her two white eggs deposited in an old hawk's nest, or in a hollow tree. A few short-eared owls may be seen flying over the frozen marsh in search of rodents.

With our first week of March, several summer residents arrive and during the month we may expect to see the song sparrow, bluebird, meadowlark, robin, red-tailed hawk, mallard, woodcock, flicker, red-winged and rusty blackbird, fox sparrow, bronzed grackle, phoebe and others. The prairie horned lark is incubating her first setting of eggs.

April brings the purple martin, mourning dove, red-

headed woodpecker, brown thrasher, Wilson's snipe, blue-winged teal, vesper, field, grasshopper, swamp and Henslow's sparrows, towhee, and red-shouldered and sparrow hawks. The myrtle warbler, white-throated sparrows and ruby and golden-crowned kinglets, are in evidence among the underbrush and low trees.

The April rains and sun have taken the frost out of the ground and the warmth of May restores the foliage to our trees and shrubbery. With the unfolding of the leaves appear myriads of insects and worms. Our later birds now arrive including the brightly plumaged orioles, scarlet tanagers, rose-breasted grosbeaks, indigo buntings and bobolinks. Our daintily attired warblers and retiring flycatchers are haunting the trees and vireos are carefully inspecting the branches and leaf stems. More ducks, shore birds, and other water fowl have arrived. The plover, and yellow legs are whistling and the gallinules and rails call to each other from clumps of old rushes which afford better protection than the young vegetation.

The phoebe, bob-white, woodcock, song sparrow, red-shouldered hawk, screech owl, mourning dove, bluebird, robin, bluejay, crow, brown thrasher and towhee are all busily engaged in the duties of hatching their eggs and rearing their young. This is the season when birds in their ecstasy become less cautious and afford splendid opportunities for observation.

You should arise before dawn, because with the first glimmer of daylight certain birds burst forth into song. Before the sun has risen many voices may be heard on the meadows, in the woodlands or about the marshes. Some birds found singing at this time of the year are silent during the day, but with the approach of twilight we are greeted with the carol of the wood thrush, the hymn of the vesper sparrow and the cooing of the mourning dove. Night hawks are conspicuous and, as the curtain of night falls, we hear the mournful cry of the owl and the weird note of the whip-poor-will.

In June nesting is at its height. The male birds are

also in full song, but the opportunity for bird observation is not so good. Our feathered friends have more serious obligations and are now too preoccupied to devote much time to courtship so we see less of the female. The males may be seen or heard regularly for the next two to four weeks.

Birds such as the prairie horned lark, killdeer, song sparrow, phoebe, bluebird and robin are preparing to rear a second brood. Two weeks ago their first nests were occupied with eggs that hatched before many of our summer residents had returned from the South. If we venture into the meadows, through the orchards or to the woodlands, many fledgelings are encountered. The parents are uneasy at our presence and manifest their displeasure by showing little fear in their efforts to protect their offspring. The flycatchers, vireos, and thrushes are now sitting upon their eggs. These birds usually rear but one brood during a season.

The marshes are gradually drying up and the few hollows which still contain water are attractive places for rails, herons and bitterns.

In July the goldfinches act as vivacious as most birds do in May. Thistle down, now floating in the air, is used as a lining for their nests, while they largely subsist on the thistle seeds. By the middle of July our graceful swallows have completed household duties and are congregating along the marshes and lakesides. Flocks of tree and bank swallows often mingle and move over the marshy sloughs, alighting at sundown on the telephone and telegraph wires. Few birds sing during the heat of the day except indigo buntings, towhees, dickcissels, field sparrows, song sparrows and robins. These birds are more domestic and prolific than swallows and the duties of rearing a second family will consume the entire month.

The bobolink is losing his gay coat of black and white and buff and is preparing for a raid upon the southern rice fields where he will travel under the disguise of "ricebird." Less capable of flight while shedding his feathers, he

retires to cornfields to molt, where he is afforded an unobstructed view on all sides as a protection against natural enemies.

August is the general month for molting. About the only birds demonstrative about nest-building at this late date are some of the goldfinches and cedar waxwings. Many of the latter have remained in flocks through the entire winter, spring, and early summer, but are now busy nest-building in some isolated orchard, shade tree, or evergreen. A walk through the timber, along the water-courses and over fields will disclose little bird-life as birds are naturally shy and evasive while molting. Their flight even is defective so they remain within the shelter of heavy grass or brush. We may see a dozen wood ducks about some little lagoon or wooded lake, probably two adults and their offspring. Woodpeckers may be seen moving about in families, two redheaded woodpeckers guiding four or five immature birds which have not attained the scarlet headgear. Only during the early hours of morning do the birds show any animation. At that time we occasionally hear the song of a catbird, the call of a cuckoo, the note of a pewee and the mellow twitter of a goldfinch as he darts back and forth singing at every dip of his undulating flight.

This is a good month to examine and collect birds' nests. They have not long been exposed to the weather because the foliage is still on the trees. Many nests are kept in their proper shape only by removing the twig, stem or limb to which they are attached. The weather is still more or less sultry but we may venture into the damp or dark places without the annoyance of mosquitoes, gnats, and other insects which are so numerous during June and July.

With the arrival of September we see many new forms about our shade trees, gardens and groves. They are not usually our summer residents in different plumage, but birds from a more northerly latitude. The warblers have begun their annual southward journey. Along the

pebbly beaches and sandy shores hundreds of little waders are moving about in a systematic search for aquatic life. Many of them are marked differently than they were five months ago. During the interval they have visited the tundras and barrens about the Arctic Ocean, deposited their four eggs, reared their young and are now feasting as they move by degrees to the south. Three months from now some of them will be hundreds of miles south of the equator.

Owls seek more open situations at this time of the year. They realize that the territory is populated by transients and the time is to be improved by hunting in the open where smaller forms of bird-life are so much in evidence. It is still possible to find an occupied nest of the goldfinch or cedar waxwing though undoubtedly the birds have been accidentally delayed. The male goldfinch is losing his brilliant coat of black and yellow and is assuming a covering of dull greenish black not unlike his mate. Great flocks of blackbirds comprising red-wings, rusty blackbirds and cowbirds forage in the marshes and descend upon the grain fields. The graceful little terns called seagulls are moving leisurely southward along water-courses.

On the upland prairies large flocks of golden plover are feeding on wild berries, grasshoppers and crickets. The birds have lost the handsome black breasts and there is nothing about their appearance to identify them, save their clear mellow whistle, or call-note, which they use when moving swiftly in compact flocks over our uncultivated land. As Helen Hunt Jackson says:

"October the month of carnival of all the year,
When Nature lets the wild earth go its way,
And spend whole seasons on a single day."

With the fall or turning of the leaves in October, we lose our insectivorous birds. Belated warblers are hurrying southward and occasionally a phoebe may be seen lingering about the nesting place, loath to leave the little bridge or old well with its past associations. As we

walk through the dead leaves of the woodlands, willow, olive-backed and hermit thrushes are startled from the ground and fly to the nearest branch of some leafless tree. Small flocks of white-throated, fox or white-crowned sparrows are busily feeding in the fence corners. The junco has returned from the Canadian provinces and will remain with us until a mantle of snow forces him to seek food elsewhere.

Golden and ruby-crowned kinglets moving in company with brown creepers comprise a fearless trio while inspecting the trees on our lawns and in our parks. The little kinglets look twice as large as they did last April, the fluffed feathers offering more resistance to the October chill. The frosted vegetation in sloughs and bayous now exposes many a gallinule, coot and rail, where many are shot by pot-hunters lacking in sportsmanship.

The large cities are revisited by various forms of sea birds providing there is a water frontage. During the late fall, winter and spring months Bonaparte's, herring, and ring-billed gulls visit the shores of lakes and rivers, especially when these waters are navigable, to procure the refuse. Wilson's snipe is again on the marsh where his flight taxes the skill of the best gunners.

November leaves us with a limited variety of birds, most of which are found in flocks. Robins still loiter in sheltered places and the hardy meadow-lark lingers about his favorite pasture. On a bleak morning we hear his merry chipper which seems a protest against snow and ice. Flocks of mallards gorge themselves in the cornfields. The birds are then prepared for a continuous flight of two thousand miles, though they defer such journey as long as they can find open water nearer. We have the mallard with us from October to late in December. With January comes a general freeze up of his feeding grounds, so he moves just far enough south to return at the first thaw in February. Many mallards reach Canada in March. Fifty years ago we had this noble game bird with us at least eleven months in the year. Great flocks of prairie chickens are now roaming the

cornfields. Families have combined with others and these flocks join larger ones until hundreds of birds have banded together so to remain until April.

Field and tree sparrows are sheltered along the roadsides in the thickets and about truck gardens. A few large hawks, such as the red-tailed, goshawk and rough-leg are in evidence. The two latter are migratory but often spend the winter with us. The rough-leg is sluggish, his habits reminding one of an owl. The little screech owl calls weirdly through the long nights of November when other bird voices are hushed. December causes the crows to "hustle for a living." Rather than migrate during severe weather they sometimes starve. One good word may be said here in behalf of the crow; he has never been known to eat the remains of his own kind nor does he attempt to fight with his fellow birds over some morsel which he may have chanced to acquire.

This is a good time to set up a little "free lunch counter" for the birds by nailing a board to your window-sill or nearby tree. You will undoubtedly make friends with several sociable birds. Place a generous amount of corn, bread crumbs and suet on this shelf, or the latter if preferred may be tied to a limb. Downy woodpeckers and white-breasted nuthatches are very fond of suet and the nuthatch will usually prevail upon some chickadee to visit the same eating place. Occasionally a bluejay or English sparrow will steal the larder intended for the other birds, thus justifying one in shooting them on sight.

Visit the woods on a cold December morning when snow is on the ground. You will be surprised at the friendliness of the chickadee. He even alights upon your head or shoulder and will readily eat bread crumbs from your hand.

G. A. A.

SUGGESTED EXERCISES IN GROUPING BIRDS.

It is well to impress upon the minds of the pupils the fact that every part of nature is menaced by insect foes and there are birds to protect us from each form so that each insect seems to have its particular enemy.

Flycatchers sit on a limb and wait for insects to pass when they snap them up and return to the perch to await other victims; the grouse get the insects on or near the ground; the orioles search the foliage and branches; the warblers, in addition, search the bloom in spring; the woodpeckers go into the bark and even into the body of the tree for larvæ; the creepers, chickadees, etc., gather food from the cracks and outer bark; the wrens creep about every nook and corner; the air is cleared of swarms of insects by swallows and swifts during the day and by nighthawks at dusk, while snipe-like birds probe into the mud for insects.

While it is usually not profitable for the pupil to commit any catalogue of birds possessing certain characteristics, yet many helpful exercises may be suggested while the teacher with the pupils runs through the Study. This grouping of birds into such classes is best done after the Study has been used for some months. We suggest a number of these but the classifications we here make are simply for the guidance of the teacher, as the pupils get the most out of the exercises by compiling such lists for themselves under the teacher's guidance.

BIRDS OF THE DOORYARD.

Bluejay, mocking-bird, house wren, robin, English sparrow, chipping sparrow and chinney swift.

BIRDS THAT FEED ON THE GROUND.

The various grouse, also the plover. In addition to which we might add the roadrunner, mourning dove,

bobolink, meadow-lark, horned lark, fox sparrow, English sparrow, dickcissel, crow, towhee and brown thrasher.

BIRDS THAT FEED AMONG THE FOLIAGE OF TREES AND BUSHES.

The cuckoos, scarlet tanager, blue-gray gnatcatcher and the kinglets.

BIRDS THAT FEED ON TRUNKS OF TREES.

All the various woodpeckers and sapsuckers, in addition, we may add the black and white warbler, brown creeper, titmice, nuthatches and chickadees.

BIRDS THAT FEED ON THE WING.

This comprises the swallows, including the purple martin, also the nighthawk and its relatives, the red-headed woodpecker, the ruby-throated humming-bird, cedar waxwing, the various flycatchers and vireos and the terns.

BIRDS THAT FEED AROUND THE EDGE OF POOLS AND LAKES.

The various snipe, sandpipers, plovers, except the upland plovers, also woodcock, Louisiana water-thrush and dipper.

BIRDS THAT FEED BY WADING.

The various herons, rails and bitterns with their near relatives; also the flamingo, the white ibis, the roseate spoonbill, the yellow-legs and the long-billed curlew.

BIRDS THAT FEED WHILE SWIMMING IN SHALLOW WATER.

The various river ducks, also Canada goose, Wilson's phalarope, and avocet.

BIRDS THAT FEED BY DIVING FOR FISH.

Include the loons, the grebes, the murres, the tufted puffin, cormorant, osprey, belted kingfisher and the mergansers.

BIRDS THAT FEED ON MAMMALS.

The shrikes, owls and hawks.

BIRDS THAT FEED ON CARRION:

The gulls, kittiwake, vultures, crows, raven and magpie.

BIRDS THAT LAY WHITE EGGS.

As a rule all birds that nest in hollow trees or in deep burrows, where the eggs remain in the dark, lay white eggs. Following is a partial list: double-crested cormorant, white pelican, hooded merganser, bluejay, Canada goose, Wilson's petrel, tufted puffin, various owls, bald eagle, passenger pigeon, mourning dove, various woodpeckers, belted kingfishers, bob-white, quail, phoebe, least flycatcher, goshawk, Carolina parakeet, purple martin, tree swallow, short-billed marsh wren and ruby-throated humming-bird.

BIRDS THAT DO NOT CONSTRUCT OR USE ANY NEST.

Brunnich's murre, turkey vulture, black vulture, whip-poor-will and nighthawk.

BIRDS THAT LAY THEIR EGGS IN HOLLOWES OR NESTS
CONSTRUCTED BY OTHER SPECIES.

Horned owl, screech owl, burrowing owl, barred owl, saw-whet owl, sparrow hawk, wood duck, hooded-merganser, bufflehead, American merganser, golden eye, cowbird, house wren, and tree swallow.

BIRDS WHICH ARE RESIDENT THROUGHOUT THE YEAR
IN A GIVEN LOCALITY.

The various grouse, crow, bluejay, Canada jay, Clark's nutcracker, the nuthatches, downy woodpecker, screech owl, horned owl, barred owl, the eagles, chickadees; some of the resident birds migrate for a short distance, so that in some cases, while we may have some species of bird throughout the year, it may be a different bird in winter and summer.

BIRDS WITH CONSPICUOUS RED OR ORANGE PLUMAGE.

This list is so easily compiled by consulting the charts that no printed list is necessary.

BIRDS THAT ARE WHITE.

White-tailed ptarmigan, snowy owl, common tern, caspian tern, kittiwake, ring-billed gull and snowflake. Are all these birds white in both winter and summer? Do they differ from albinos?

SPECIES WHICH ARE FAMOUS AS GAME BIRDS.

The various ducks, including the Canada goose, plovers, snipes and sandpipers, including woodcock, and grouse.

SWEETEST SONG BIRDS.

Thrushes, including the veery and robin, also the dipper and brown thrasher, mocking-bird, ruby-crowned kinglet, rose-breasted grosbeak, the wrens, indigo bunting, meadow-lark, bobolink, the sparrows, purple martin, Maryland yellow-throat and yellow-breasted chat.

BIRDS WITH CRESTS AND TOPKNOTS.

This is so easily compiled that no list is necessary.

BIRDS FREQUENTING BARNS AND OUTBUILDINGS.

Purple martin, barn swallow, phoebe and cliff swallow.

BIRDS THAT LIVE IN OUR ORCHARDS.

Flicker, bluebird, orchard oriole, mourning dove, cedar waxwing, yellow-billed and black-billed cuckoos and red-eyed vireo.

BIRDS THAT FREQUENT THE TREES AND UNDERBRUSH ALONG THE ROADSIDES AND DRIVEWAYS.

Baltimore oriole, kingbird, brown thrasher, loggerhead shrike and least flycatcher.

BIRDS FREQUENTING NEGLECTED FIELDS AND WEED PATCHES.

Slate-colored junco, tree sparrow, vesper sparrow, dickcissel and goldfinch.

BIRDS THAT LIVE IN OUR MEADOWS AND PASTURES.

Lark sparrow, grasshopper sparrow, bob-white, meadow-lark, cowbird and bobolink.

BIRDS INHABITING UPLAND PRAIRIES.

Horned larks, prairie hen, upland plover, Savanna sparrow, Smith's longspur and burrowing owl.

BIRDS THAT LIVE ON THE TIMBERED HILLSIDES.

Red-headed woodpecker, crow, red-tailed hawk, screech owl, whip-poor-will, warbling vireo, red-bellied woodpecker and scarlet tanager.

BIRDS PARTIAL TO BERRY BUSHES, SAPLINGS AND SMALL WILLOWS.

Indigo bunting, yellow warbler, song sparrow, field sparrow, fox sparrow, traill's flycatcher, golden crowned kinglet and towhee.

BIRDS THAT ARE PARTIAL TO EVERGREENS.

Bronzed grackle, pine warbler, cross-bills, blackburnian warbler, bay-breasted warbler, blue-headed vireo, and pine grosbeak.

BIRDS THAT HAUNT DAMP GRASSY PLACES.

Maryland and western yellow-throat, marsh wrens, swamp sparrow and short-eared owl.

BIRDS INHABITING DAMP UNDERBRUSH.

Woodcock, yellow-breasted chat, cardinal, rose-breasted grosbeak and redstart.

BIRDS OF DAMP WOODLANDS.

Yellow-bellied flycatcher, olive-sided flycatcher, ruffed grouse, wood pewee, veery, wood thrush, black and white warbler and ovenbird.

BIRDS FREQUENTING OUR TIMBERED LAKES.

Wood duck, hooded merganser, loon, tree swallow, crested flycatcher, Canada jay and osprey.

BIRDS FREQUENTING TREES ALONG STREAMS AND LAKES.

Horned owl, sparrow hawk, prothonotary warbler, downy woodpecker, belted kingfisher, Louisiana water thrush and chickadee.

BIRDS LIVING ABOUT OPEN PONDS AND GRASSY SLOUGHS.

Marsh hawk, mallard, blue-winged teal, pied-billed grebe and black tern.

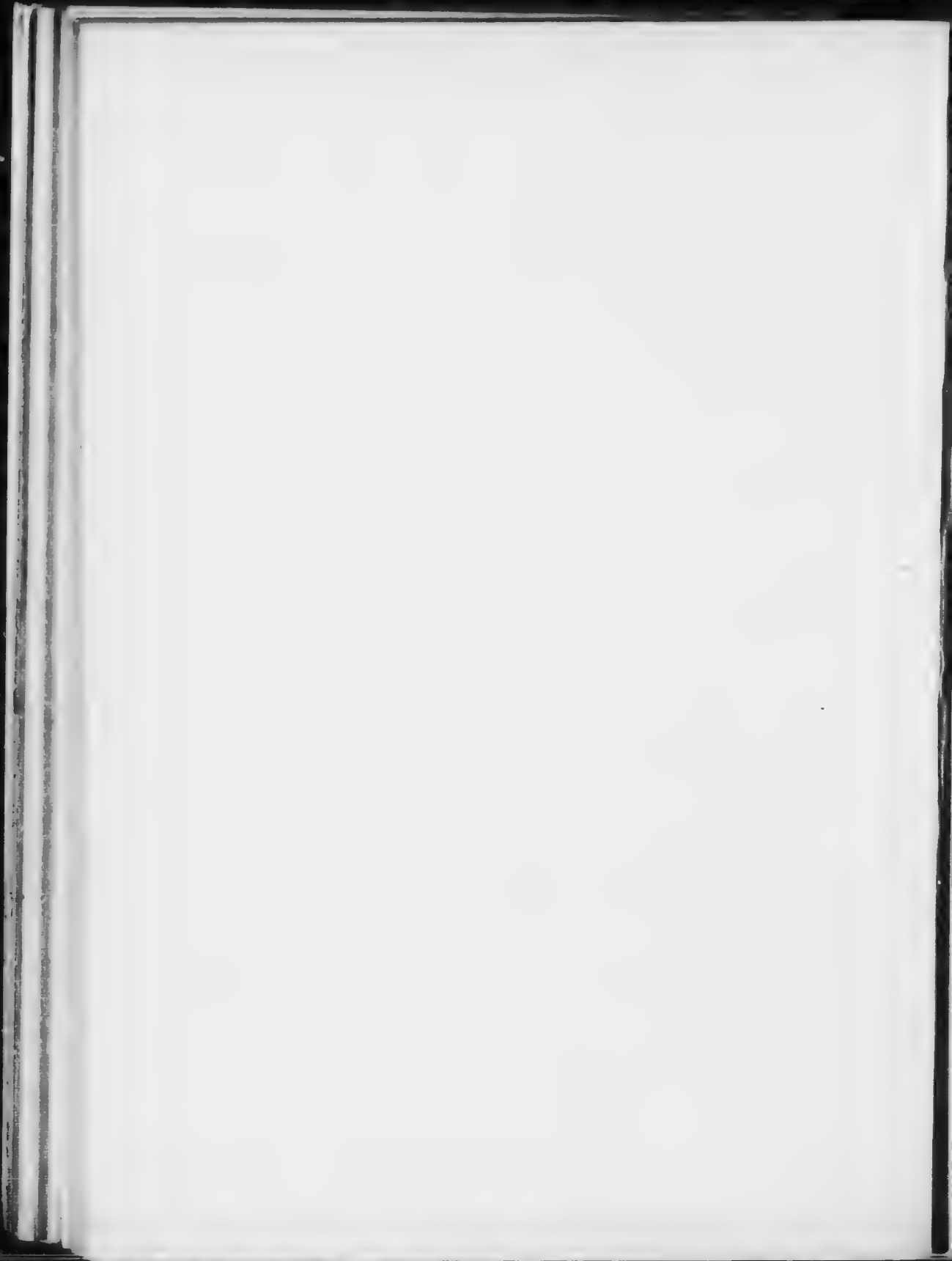
BIRDS THAT INHABIT OPEN SWAMPS AND BOGS.

King rail, sora rail, Virginia rail, coot, Florida gallinule, bittern, least bittern, red-winged blackbird, yellow-headed blackbird, long-billed marsh wren and black-crowned night heron.

BIRDS FREQUENTING OUR SANDY SHORES AND GRAVEL BEACHES.

Spotted sandpiper, killdeer, piping plover, black-bellied plover, common tern, willet and sanderling.

G. A. A.

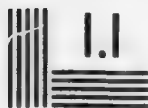


PART II.
SPECIAL DESCRIPTIONS OF
THE STUDY.



MICROCOPY RESOLUTION TEST CHART

ANSI and ISO TEST CHART No. 2



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EXPLANATORY.

Part II of the manual is a condensed description of the subjects illustrated in the Study.

The number appearing before the name of the various species of birds is the one sanctioned by the American Ornithological Union and is called the A. O. U. nomenclature. The length in inches of each species follows the name in the manual while in the Study the relative size is given. This should be carefully shown to avoid misconception. This length represents the distance from the tip of the bill to the end of the tail, assuming that the bird is placed lengthwise on a table and the measurement so obtained. Color descriptions usually refer to the male in spring, or mating plumage. In the general description of the bird under discussion, the author places considerable emphasis upon the bird's mating habits because he has found this study so fascinating, and he realizes that the subject is usually treated in a superficial way by the casual observer or by writers preparing material for beginners. Again, it is during the breeding season that we may best study the home life of the bird and note at this most interesting period the characteristics and traits peculiar to each species, for there is the real bird best shown. This treatment of nesting habits is usually placed last in each article.

On seeing the picture of the bird, one naturally asks, "Is the bird found here?" So the information regarding the range is placed at the first part of each article.

With all the sentiment for the beauty of form, of motion, of song, etc., many make the prosaic inquiry, "Of what use is this bird?" This information is attempted, though it is impossible to compute in dollars the vast economic value of these feathered friends.

Some important related forms not represented on the Study are also described, usually comparing them with the most nearly related species that is represented.

While the scientific name is given, the common name accepted by the A. O. U. list is the one used and is the one true bird lovers should use and so help make the accepted one, thus avoiding confusion.

Questions usually follow the family descriptions. The few given are intended to suggest the many.

Let the Study lead you out of doors; for such is the design of this system, such is the new education.

1. DIVING BIRDS.

Six species of Grebes, or Lobe-footed divers, are found within the limits of North America. Grebes are so aquatic that they seldom venture upon the land, where they are almost helpless, resting on the entire tarsus instead of toes. They dive and swim with such skill that they were able to escape the shot by "diving at the flash" of the muzzle loading shotgun formerly in use. Various popular names are applied to show the skill of these birds in diving; they can swim with only the tip of the bill above water. They subsist largely on fish which they are able to capture under the water, propelling the body by feet alone. The nests of the grebes are masses of decayed vegetation which the birds gather beneath the water, and arrange among the growing vegetation by anchoring to aquatic plants so that the nests rise and fall with the water.

The Loon family comprises five species in the Northern Hemisphere, three being found in the Great Lakes region. They are almost as aquatic as are the grebes. They visit the land only to nest at which time they move by using the bills, wings and feet, nesting so near shore as to slide noiselessly into the water. They capture fish, as do the grebes, by pursuing under water, progressing by means of feet alone.

The Murres, Puffins, Dovekies belong to the family Alcidae, which numbers thirty species, all found in the northern Hemisphere, most of them on the Pacific Coast. They pass most of their lives on the open sea. They nest in colonies, vast numbers frequenting cliffs. On land they are slow and awkward but are good fliers, swimmers and divers. In pursuing fish beneath the water they use wings as well as feet. Many of these lay but one egg.

QUESTIONS.

Since these divers lay only one or two eggs, and Grouse lay so many, what about the relative danger to be met on water and on land? What advantage has foot of grebe over that of duck? Would you expect thicker and more oily feathers on diving bird or on swimming bird or on wader? Why? Why do divers nest on or near water? Are the divers game birds? Why? What of edible quality of any bird living on fish? Why are these birds usually found on or near the sea?

3. HORNED GREBE. *Colymbus auritus*. 13.5 in.

The Horned Grebe, often called Hell Diver, Diver, or Water Witch, is frequently mistaken for the pied-billed grebe. A bird of central North America, occurring from the Atlantic to the Pacific, it is a common migrant in the Great Lakes region. It nests in northern Minnesota and in the lagoons of Manitoba and Alberta, and is found in the Devils Lake region of North Dakota.

In 1900, while camping at Sweetwater Lake, North Dakota, I found holboells, pied-billed and horned grebes inhabiting the grassy sloughs along low prairies. In the regions about the shores of the Lakes, one thousand western grebes were breeding in company with five hundred eared grebes. In general appearance and size, horned and eared grebes are quite similar, the eared being the western form. While wading about among these floating nests of the grebes, the birds would dive, striking against my boots as they moved about beneath the water.

The notes of the grebes are shrill and penetrating, reminding one of the constant trilling of frogs and toads in the marshes in early spring. When hundreds of grebes are calling constantly during the night, the sound is weird, but so in keeping with the desolate country as to be scarcely noticeable after a few days. It is an even tone pitched in a high key like the strident tones of a locust.

The birds lay from four to nine bluish white eggs which they cover with decaying vegetation which soon stains

them. When the eggs are thus covered the heat from the sun's rays and the decay of the vegetation produce a warmth sufficient to incubate the eggs without the presence of the bird; the grebes, however, often sit upon their nests or at least remain close to guard their treasures. When the young are hatched they may be seen riding on the backs of the old birds in the open water, but usually close to cover. At the approach of danger the old bird dives like a fish and arises to the surface many yards away, with the little fellows still clinging on.

6. PIED-BILLED GREBE. *Podilymbus Podiceps*.
13.5 in.

The Pied-billed Grebe, commonly called Hell-diver, Diedapper, Dabchick, Waterwitch, is often mistaken for the horned grebe. It ranges from Argentine Republic north to Hudson Bay and Great Slave Lake, breeding throughout the range.

Grebes are unexcelled as divers as they swim and dive like a fish, and reach a depth of five or six fathoms. They are the most aquatic of all North American birds found in the interior, but are helpless on land, unable to walk or rise on the wing. Like other grebes, they rest on the tarsus while on land as shown in plate. The toes are not connected by a web, as in the ducks, but each toe is equipped with separate lobes, enabling the birds to propel themselves through the water, either on or beneath the surface, with great rapidity. They have no tail feathers.

The floating nest of decaying vegetation is anchored to the reeds or rushes in from one to five feet of water. The birds obtain the material for these floating nests from the bottom of the lakes and marshes where the nest is situated. It is estimated that the birds make two hundred trips below the surface to obtain the required amount of nesting material. The pied-billed arrives in the Great Lakes region in April, and may remain to breed around the lagoons and lakesides of Illinois and Indiana. A few pairs nest within the city limits of Chicago.

The writer's collection contains a nest of nine eggs

taken June 18, 1902, in Cook County, Illinois. The eggs of all the grebes are immaculate when laid, but soon become badly nest stained.

7. LOON. *Gavia immer*. 32 in.

The Loon, or Great Northern Diver, is migratory through northern Illinois, although a few formerly bred in the Fox Lake region. Michigan and Wisconsin are favorite summer resorts for the loon, and many pass northward into Canada to breed. During the spring and fall, loons abound on the Great Lakes, and are frequently caught in fish nets or on set lines which have been baited with minnows. One pair of loons usually reign supreme on each little inland lake among the northern woods.

They usually migrate by night, flying high. During the breeding season their weird notes echo among the pines when all else is still. The cry of the loon is not unlike an outburst of maniacal laughter, hence we frequently hear the expression, "crazy as a loon." Like the grebes, the loons are practically helpless when on land; but are excellent swimmers and divers and strong direct fliers.

The nest is constructed near the water, often on a partially submerged muskrat house. Sometimes the two large eggs are laid on the bare sand or gravel just above the water's edge, so that it is possible for the parent to slip quietly from her nest into the water and swim rapidly to the farther side without exposing even the head. The eggs are dark olive green, spotted and blotched with brown.

12. TUFTED PUFFIN. *Lunda Cirrhata*. 12 in.

The Tufted Puffin is a western species living on the Pacific Coast from California to Alaska. It also frequents the opposite shores of the same ocean, occurring in considerable numbers from Japan to Bering Strait. Four varieties of puffin are found in America.

The bills of the puffin are short, stout and extremely broad vertically, with little horizontal width. The upper

mandible projects beyond the lower, producing a resemblance to the parrot. A peculiar comb-like excrescence forms on bill at nesting time, a sex mark. The general color of the bird is black with a conspicuous white faced mask; the long flowing yellow ear tufts are curved inward like the horns of a ram.

Aside from the gulls and terns, puffins are probably the uneasiest birds about their breeding grounds. When not excitedly moving about the rocks, they are generally uttering their piercing notes, often more shrill than the scream of the gull. When the birds enter their burrows they may be heard uttering a sound not unlike a disturbed feline.

Puffins are sociable birds, found in the uninhabited portions of our seacoasts, where they deposit their single white egg in burrows. Both male and female assist in incubation. From the burrow containing the downy young, the old bird may be removed with the hand when the nestling is usually found clinging by the bill to the wing or tail feathers of the parent.

23. MARBLED MURRELET. *Brachyramphus marmoratus*.

Marbled Murrelets, as the name implies, are diminutive murre. There are several varieties all making their homes on the Pacific ocean, usually on the islands. Large numbers of this species are observed at Sitka, Alaska, and they inhabit the Aleutian Islands, where they reach their northern limit at their breeding grounds in this chain of remote islands, while the southern range is as far southward as Vancouver Island and the coast of British Columbia. They fly rapidly and swim and dive like a grebe, but seldom alight except in rocky places, where it is possible for them to launch into the air and eventually return to the water, for the legs of these birds are set so far back upon the body as to make them extremely awkward on land.

The eggs are deposited in holes made in the turf or sod

overhanging the brow of a cliff. One and sometimes two eggs are laid.

31. BRUNNICH'S MURRE. *Uria lomvia lomvia*.
16.5 in.

Brunnich's Murre ranges through the islands and along the coast of the North Atlantic and Arctic oceans.

Murres are aquatic birds and like the auks and puffins are eminently gregarious. This species is the only variety that reaches the interior of North America, as occasionally specimens are observed on the Great Lakes, where they have evidently strayed out of their course, perhaps have been carried from the seacoast by inclement weather. These birds are found usually on the Atlantic coast from New York northward to the Arctic regions. Murres inhabit the islands throughout the Arctic ocean off the coast of Asia and Europe.

In Europe they are robbed of their eggs for food. Each female deposits the single egg on the bare rocks, often without any protection from the elements. The eggs are remarkably well adapted to their surroundings as they are thick shelled, long and pointed, so that when disturbed, the eggs do not roll off the cliffs but simply describe the arc of a circle. Hundreds of birds may be found incubating within a radius of one hundred yards, sitting peaceably side by side in their congested quarters.

The eggs show marked variations; some are green with large black markings, others are pure white, still others are yellow with chocolate scrawls. This great variation in coloration may enable each bird to recognize her own egg. Clouds of birds may be seen circling not far from some huge rugged rocks jutting out into the raging sea, while uttering a syllable which sounds exactly like "murre," from which they take their name.

These birds have many natural enemies, among them the various gulls which have a habit of destroying the eggs whenever the parents are forced to leave them. These beautiful but thieving gulls actually carry these immense eggs in their mouths, flying to some remote part of the

island or rocks where they puncture the shell and devour the contents. In spite of enemies and in spite of the single egg laid, like so many of the diving birds, they maintain their numbers until killed off by man.

34. DOVEKIE. *Alle alle*. 8 in.

The Dovekie, commonly called Sea Dove or Little Auk, is a little fellow with short bill and legs, inhabiting the Atlantic Ocean from the Gulf of St. Lawrence northward. Dovekies probably do not breed south of Greenland; in winter they occur in New Brunswick, New Foundland and Labrador, becoming abundant off Exeter Sound and along the west coast of Baffin Bay.

Probably the most accessible breeding grounds are in Iceland. Many European bird lovers find that northerly spot much more accessible than any similarly located place to be reached from either side of the American continent. Iceland is a veritable bird paradise. Myriads of gulls, sea ducks, shore birds and boreal land birds, such as the ptarmigan, gyrfalcon and finches, haunt the bleak regions of this island.

The dovekie deposits her single large pale greenish blue egg in crevices of the sea cliffs.

Gulls and Terns belong to one family; about forty species of the one hundred known are found in North America.

2. LONG-WINGED SWIMMERS.

Gulls and Terns belong to one family; about forty species of the one hundred known are found in North America.

Gulls are maritime and pelagic, though some are found inland. Gulls are larger and stronger than terns though less graceful and active on the wing. The bills point forward and not downward in flight. They get food largely by skimming it from the surface of the water, or take it from the land, and do not plunge for it, as do the terns. They are largely scavengers, though some feed

on small mammals and eggs and the young of other birds. Better swimmers than the terns they spend more time resting on the water; they nest in colonies usually on ground, sometimes on rocky ledges, and rarely in trees.

Terns visit the shores of salt and fresh water, especially salt. They are often called sea swallows because of their strong graceful flight. They plunge after fish; in flight the bills point downward toward the earth.

The order Tube Nosed Swimmers contain the greatest fliers. Petrels are closely allied to albatrosses, shearwaters and fulmers. Petrels are pelagic, visiting land only to nest. They are strong graceful fliers, and are noted for following ships.

Cormorants and Pelicans belong to the order of Totopalmate Swimmers, as all four toes are united by web. The cormorants are found in all parts of the world, ten of the thirty species being found in North America. The double-crested cormorant is the most common in the United States. While usually maritime some frequent bodies of fresh water. They are gregarious often breeding in colonies. Flight is strong and duck-like near the surface of the water, except when migrating. They dive for fish from the water, or dive from perch like the kingfisher, but not from the air.

Three species of Pelican are found in North America, only one of which is found in the interior. Pelicans are gregarious, nesting in colonies. Their flight is strong, but leisurely, several wing strokes being followed by a short sail; all birds of a flock flap wings and sail in unison. The peculiar feature is the large pouch used as a scoop net in catching fish. Some species plunge for food, while others use the pouch while swimming.

QUESTIONS.

Carefully study bills found on this chart. Compare that of pelican and skimmer, see chart 48. Why are birds shown on chart II not game birds? Which birds are most swallow-like of group? Why is petrel so called? Why does petrel seem to be walking on the water?

40. KITTIWAKE. *Rissa tridactyla tridactyla*. 16 in.

This medium-sized gull is supposed to take its name from the note, which is the shrill "Kit-ti-wake." Almost exclusively a seagull we rarely meet with this species on our large inland lakes. They are boreal and Mr. Peary, our Arctic explorer, found them breeding abundantly on the coasts of Greenland. They are common to the Atlantic waters of both Europe and America. In winter and early spring the cry of the kittiwake echoes along the rocky shore of the New England coast.

They do not nest upon the ground like most other gulls, but resort to the rocky and almost inaccessible cliffs overhanging the water. The famous Bird Rocks in the Gulf of St. Lawrence are probably the farthest south these birds breed, constructing substantial nests of grass and seaweed on inaccessible ledges. The ground color of the two or three eggs is yellowish buff or greenish gray marked with irregular spots of brown and lilac.

Frequently the birds nest in very close proximity to each other, resorting annually to the same filthy guano covered rocks. The Pacific kittiwake, inhabiting the northern coast of North America, breeding in Alaska, is the western form.

54. RING-BILLED GULL. *Larus delawarensis*. 18.5 in.

The Ring-Billed Gull ranges throughout North America, being more common in the interior.

Of all gulls, not excepting the herring, this bird is the commonest on the inland waters. The herring is more abundant on the Atlantic. The southern portion of the Great Lakes and the Mississippi River from Minnesota southward to St. Louis are the winter haunts of the ring-billed gull. They are more commonly found along rivers than formerly, soaring in great numbers about refuse which may be found even in remote sections, sometimes fifteen to twenty miles from any large body of water.

During extremely cold winters the lagoons in our public parks sometimes freeze to the bottom; at the time of the spring thaw these birds feed on the frozen fish which

are gradually exposed by the melting ice. They frequently rob other water birds, as a merganser or a grebe. As these divers rise to the surface with a fish the gull with a dexterous swoop seizes his prey and makes off with it. Sometimes the gulls so gorge themselves as to be seen flying away with a half swallowed fish protruding from the bill. The birds are highly useful as scavengers and destroyers of insects.

Rude nests of hay, sticks and grass are placed on the ground, usually on islands. Three buffy, clay-colored eggs, spotted and blotched with brown, are laid in May.

60. BONAPARTE'S GULL. *Larus philadelphia*. 14 in.

"This pretty little gull claims the whole of North America as its home, although it nests only north of the United States, apparently not quite to the Arctic Circle. This species is often common near streams and small bodies of water, large enough to furnish their food of fish. The three acres of the Oberlin, Ohio, waterworks reservoir, well within the city, is visited each spring by flocks which feed upon the half-domesticated fish found there. I have often seen flocks of twenty or more birds passing over plowed fields during the vernal migration, sometimes even stopping to snatch some toothsome grub from the freshly turned furrow, but oftener sweeping past in that lithe, graceful flight so characteristic of this small gull.

To the farm boy, shut in away from any body of water larger than an ice-pond, where no ocean birds could ever be expected to wander, the appearance of this bird, bearing the wide freedom of the ocean in his every movement, is truly a revelation. It sends the blood coursing hotly through his veins, until the impulse to get away into the broader activities of life, to see something of the wide land known to this winged creature, cannot be put down.

In flight they progress easily by continued leisurely wing strokes, each stroke seeming to throw the light body upward slightly as though it were but a feather's weight. In flight the watchful eye is turned hither and thither in

quest of some food morsel, which may be a luckless fish venturing too near the surface, to be snatched up by a deft turn of the wings and a sudden stroke of the keen bill. Floating refuse also is gathered from the surface of the water while the bird is resting.

It is only in the breeding plumage that this gull wears the slaty plumbeous hood. It seems doubtful if the birds obtain the hood until the second or third year, when they are fully adult. But in any plumage there are some dark spots about the head.

The nest is placed in bushes, trees or on high stumps, and is composed of sticks and grasses, with a lining of finer vegetable material. The three or four eggs have the grayish-brown color, spotted and blotched with browns, which is characteristic of 'his group of gulls.'

LYNDS JONES.

64. CASPIAN TERN. *Sterna caspia*. 21 in.

The Caspian Tern is the largest of the terns, and readily recognized by the coral red bill. Birds of wide range, they are extremely sociable, and not only nest in colonies but frequently in company with other long-winged swimmers such as the herring gull or California gull. The caspian terns frequently migrate at great heights and far from land, a course which they may pursue when traveling to their breeding grounds on the Atlantic or Upper Lake Michigan, and thus their presence is little suspected by the casual observer in the middle states.

Until the Audubon Societies patrolled many of the islands lying off the American Coast or on the large inland lakes, the eggs of the caspian tern were used for commercial purposes. Fishermen gathered them in great quantities, and the birds loath to leave their favorite islands would continue laying well into the summer months, until they finally became discouraged and would move to another locality.

These birds present a beautiful sight as they circle over their eggs at the approach of some intruder, uttering their hoarse cries. Though web-footed and with an oily texture

to the plumage, the birds seem more fond of flying than swimming. The food consists of insects captured in the air and small fish, which they capture by diving into the water while flying low over the surface.

During the last eight years the birds have greatly increased in numbers through rigid enforcement of the plumage law forbidding the selling in America of feathers of native birds. Several large colonies of caspian terns appear on the islands in the Gulf of Mexico. Other colonies have taken possession of the islands on fresh water lakes in Oregon. The eggs are usually deposited in small hollows on the beach just above high water mark. No attempt at nest building is made. Two or three clay-colored eggs are laid, thickly spotted with brown of varying shades.

70. COMMON TERN. *Sterna hirundo*. 15 in.

The Common Tern, often called Wilson's tern, sea swallow, red shank, summer gull and mackerel, is often confused with arctic tern and Forster's tern. This beautiful little sea swallow was first reported by Wilson, one of our earliest ornithologists. Formerly abundant this bird is now threatened with extinction unless protected from plumage and egg hunters. These terns perform extensive migrations, passing the winter months on the coasts of South America, often far below the equator. In summer they may be found breeding on the islands of the Great Lakes in company with herring gulls and caspian terns.

The birds are as agile on the wing as our barn swallow, and capture many flying insects. They also feed upon marine life, but refrain from playing the role of scavenger, leaving the gulls to devour any decaying animal matter.

Hundreds of terns may be found nesting together, depositing their three eggs in a carelessly constructed nest of dry grass on the pebbly beach or rocky projections just above high watermark. Quite a commotion prevails when the naturalist intrudes upon their breeding grounds; the birds rise like a cloud and fly about in majestic circles, screaming persistently until the trespasser leaves.

Early in June three eggs are laid, varying greatly in shape and color, the background is light green, buffy or drab, spotted and blotched with various shades of brown and lilac. The young are able to care for themselves as soon as hatched.

77. BLACK TERN. *Hydrochelidon nigra surinamensis*. 10 in.

The Black Tern, the only dark plumaged member of the gull or tern family inhabiting the interior portions of North America, breeds from the Gulf of Mexico to upper Canada, and from the Atlantic to the Pacific coasts, nesting even within the corporate limits of Chicago.

While gregarious, they are found in smaller groups than most of our long-winged swimmers. Largely insectivorous they capture their prey in the air. They also plunge into the water after small minnows and other marine life. Although the feet are webbed, these birds seldom swim except perhaps when migrating across large bodies of water. Their call note is a harsh shriek uttered incessantly if one intrudes upon their nesting sites usually in marshy places, preferably open country, free from timber.

The nests are constructed of decayed vegetation, dead flags and rushes, often a mere depression on a partially submerged muskrat house containing the two or three dark yellowish eggs, heavily and thickly blotched with shades of lilac and very dark brown. These birds have a habit of rolling their eggs in the wet earth and vegetation, thereby rendering them less conspicuous. I have known the birds to arrange a little nest on the top of an old grebe's nest. Often the water is several feet deep where the nests are made, but the growing reeds and rushes allow the water to remain more or less stagnant so the eggs are seldom disturbed by waves.

109. WILSON'S PETREL. *Oceanites oceanicus*. 7 in.

The sailors have always harbored a friendly feeling for these sea-loving birds. They tell you that Mrs. Carey lives on the edges of the seas and the petrels are her chick-

ens, hence they are frequently called Mother Carey's chickens.

Two species of petrel are common to the North American coast. Probably at least a dozen other forms have been recorded on our continent as the petrels are great wanderers and frequently stray out of their course. The feet are webbed and the wings are long and powerful. The flesh is so oily, that the plucked body of a petrel supplied with a wick, similar to that of a candle, will burn for over an hour.

Petrels feed from the surface of the water, picking up food while swimming or while on the wing. They seem to delight in following vessels at sea to pick up the refuse matter thrown overboard as they fly close to the water. They also follow the breakers often seizing an unfortunate crab or crawfish that is cast up by the waves.

Wilson's petrel resorts to islands in the Southern Hemisphere during the breeding season. The single white egg, sometimes faintly wreathed with dull lavender, is incubated at the end of a three foot burrow. The tube-nosed swimmers lay but a single egg. When disturbed on their nests they emit an oily substance from their crops very disagreeable to the intruder.

120. DOUBLE-CRESTED CORMORANT. *Phalacrocorax auritus*. 30 in.

Cormorants, sometimes called water turkeys, are similar in construction to our pelicans, but the loose skin on the throat is comparatively inconspicuous, while the pelican has a pouch capable of great distension. The sea coast of America, particularly the Pacific, is the home of many cormorants of several varieties; but the double-crested is practically the only inland species, occurring from Illinois and Iowa northward into Canada during the breeding season. They are gregarious at all times even nesting in colonies. Twenty-five years ago this large bird appeared in the river bottoms of the Illinois, but the timid creatures retire at the encroach of civilization. Cormorants have all four toes connected by a con-

tinuous web. The tail feathers are long and stiff, and the birds use this appendage in progressing underneath the water where they capture fish. Like ducks, the cormorants in flight extend the neck and legs to their full length.

Of the thirty varieties of cormorants inhabiting the globe, one-third are American. When disturbed the cormorants fly at low altitudes usually over the water. Their bills are strong and decidedly hooked; this assists them in holding their prey. Unlike the gannets, cormorants do not dive from the air, but from the water or a low perch.

On the barren islands of Devil's Lake, North Dakota, the double-crested cormorant still nests in company with the ring-billed and herring gulls, Canada goose and white pelican. These islands are a paradise for the bird student. On approaching these densely populated areas the wary cormorants are the first to leave their nests. No sooner do they vacate their posts than the thieving gulls descend upon their nests and destroy their eggs.

Cormorants incubate in relays and never vacate their nests except at the approach of man. In Canada nests are frequently constructed in rocky places overlooking the water. The nests are of sticks and contain from three to five chalky eggs with a covering showing faint blue.

125. WHITE PELICAN. *Pelecanus erythrorhynchus*. 60in.

This bird is common to entire temperate North America. It is one of the largest of our water fowl, inhabiting both fresh and salt water. Like the brown pelican, this species is decidedly gregarious. Professor Jones says, "The birds travel 60 miles to catch fish for themselves and young. They often vomit up the contents of their stomachs on the ground where it quickly decays." The stench of the rookeries is almost intolerable.

These birds summer at Great Salt Lake, Utah, and on several of the large inland lakes of Oregon. I noted a colony of approximately seventy-five birds at Sweetwater Lake, N. Dakota. These are probably the only colonies which remain in the United States proper. Shoal Lake,

Manitoba, is one of their favorite nesting and breeding grounds.

The flight of the pelican is picturesque. Being heavy birds they rise from the water with difficulty, using their feet in ascending. A flock of perhaps twenty-five birds will mount into the air during the heat of the day, and circle about until they appear like mere specks against the sky.

The plumage of the adult birds is pure white with the exception of a portion of the wing which is black, which color shows in marked contrast when the birds are soaring.

Two or three eggs are deposited in a large bulky nest of grass, sticks and rubbish. The thick white shells have a chalky texture, but are soon stained with nesting material.

DUCKS AND GEESE.

3. POND AND RIVER DUCKS.

We have three classes of ducks. The Mergansers, or Shell-drakes, are fish ducks. Both the upper and lower mandibles are deeply notched with barbs, which enable the birds to capture fish while swimming with great rapidity beneath the surface of the water.

Fresh Water, or Pond and River, Ducks possess broad strainer bills, and the fourth or hind toe is without any lobe. These are the mallard, teal, shoveller, baldpate, pintail, wood duck, gadwall and black duck. This family feed or dip in shallow water or wade about the margins of pools and ponds. They are all game birds and are more edible than the deep water ducks.

Sea, or Deep Water, Ducks have a conspicuous flap on the hind toe. While possessing a strainer bill they feed less upon vegetable life than the pond ducks, and are partial to small fish and other marine life. They occur both on the coasts and in the interior. The redhead, canvasback, scaup, bufflehead, old squaw, harlequin, eider, scoters and ruddy ducks are all classed as sea ducks.

The speculum, the bright feathers on the wing, is the same for all seasons and all ages of same kind of ducks.

Geese are larger than ducks and more graceful upon land. They also differ from the ducks because the plumage of geese is practically the same in both sexes.

QUESTIONS.

Are these birds all of use to man? Name three uses to which they are put. Why are their feathers so well adapted to use in pillows, etc.? How is eiderdown obtained? Is greater abundance and fineness of down and feathers obtained from ducks ranging far to the north or farther to south? Can you think of any reason why these birds are still rather abundant even after such slaughter by pot hunters? Give two reasons why mergansers are of less economic value than the other ducks. What is wild ancestor of our common domestic duck? Explain use of duck's bill. Do ducks deserve protection? Compare bill of chicken and duck. Compare the two birds as an exercise. What ducks nest in hollow trees?

729. AMERICAN MERGANSER. 25 in.

The American Merganser, commonly known as the merganser, is larger than the red-breasted or hooded. The mergansers are common winter residents on the Great Lakes, breeding through northern Michigan and Wisconsin northward. The female closely resembles the female red-breasted merganser; the male is without any crest, the head being dark greenish black. The under parts are a light sulphur yellow, but the feathers bleach and become white when life is extinct and the specimen is exposed to the light.

130. RED-BREASTED MERGANSER. *Mergus serrator*. 22 in.

The Red-Breasted Merganser ranges throughout the northern part of North America, breeding from northern Illinois and New Brunswick to the Arctic regions, wintering from southern United States to Cuba.

The red-breasted merganser inhabits Europe, Asia and America, breeding on the British Isles, Iceland, Greenland, Labrador, Alaska and the Magdalen Islands in the North Atlantic. During the fall, winter and spring months they frequent the waters of northern Illinois and Indiana; in March and April they resort to the lagoons of Lincoln Park, Chicago, and feast upon fish, exhibiting at times but little fear of man. The bold, venturesome gulls lurk about the lagoons, and when a merganser arises with his prize, a gull swoops down and in the twinkling of an eye robs the duck of his morsel. The three mergansers, the red-breasted, American and hooded, generally known as fish ducks, shelldrakes or sawbills, frequent swift running streams, ponds and lakes, where they feed almost exclusively upon fish, which they pursue and capture under water. Their deeply barbed bills are especially adapted for catching and holding fish which the birds bring to the surface before swallowing.

The legs of all fish ducks are placed far back on the body, enabling their owners to outswim the other ducks. They frequently rest upon logs and stumps of trees found in or near the water. The hooded mergansers are the only saw-bills whose flesh is at all palatable, and they are the handsomest of the tribe, the males rivalling the wood and harlequin ducks in beauty. So they are not only slaughtered by the sportsmen, but they are also sought by the taxidermist and plume hunter, consequently are becoming scarcer.

Among brushwood, bowlders and grass near the water's edge, often on islands, the female merganser constructs a bulky nest of grass, leaves and stems, lined with a moderate quantity of down and feathers; from six to twelve dark drab eggs are laid having a greenish or reddish tinge. The beautiful male deserts his mate while she incubates the eggs and cares for the young.

Mr. Chamberlain says, "I paddled after a brood one hot summer's day, and though several times they were almost within reach of my landing net they eluded every effort to capture them. Throughout the chase the mother

kept close to the young birds, and several times swam across the bow of my canoe in her efforts to draw my attention from the brood."

131. HOODED MERGANSER. *Lophodytes cucullatus*.
15.5 in.

The Hooded Merganser ranges and breeds throughout America generally, wintering in Cuba and Mexico. It breeds only sparingly throughout the United States and southern Canada. Unlike most of our ducks it is not gregarious at any season of the year.

The hooded merganser is the smallest of the three fish ducks common to America. The males are handsome birds with a conspicuous black and white crest. Our first impression of a male hooded merganser is that of an extremely large headed bird, so close and thick is the hood of white distinctly bordered with black. The hood disappearing after nesting season, it is then often mistaken for the red-breasted merganser.

They feed by pursuing and capturing fish and other marine life beneath the water. They manifest a decided preference for fresh running water and are regularly observed along the rivers of Wisconsin, Illinois, Indiana and Michigan.

Like the other mergansers the birds avoid the marshes during the breeding season, and select a hollow stub or log in which to deposit their eggs. Frequently this cavity is in a tree growing in or near a secluded spot along some woodland watercourse. Like the wood duck the entrance to the nest appears too small to admit the bird's body. The writer has witnessed a female merganser fly directly into a cavity containing her nest and eggs without alighting at the entrance.

The shell of the pure white eggs is extremely thick. The writer has thirteen taken in April in Montana. The bird had removed considerable down from her breast, and this was placed about the eggs which enabled them to incubate during the absence of the parent.

132. MALLARD. *Anas platyrhynchos*. 23 in.

The Mallard, or Greenhead, is a large, handsome duck, common during the migrations to all temperate North America from the Atlantic to the Pacific; nesting usually in the northern United States and northward, wintering in southern United States. A few remain and breed about isolated sloughs in the prairie sections of Illinois and Indiana. The female has the same quack, as that of our domestic duck, which has descended from the mallard and readily crosses with it.

The mallard is distinctly a fresh-water duck, feeding usually by dabbling or dipping in shallow water. In the fall, great flocks of these birds descend upon the grain fields and gorge themselves. They are hardy birds, often remaining in the middle United States until late in November, returning during the first thaw of February. It is abundant and a great favorite with the sportsmen.

Ten bluish white eggs of this duck are in my collection from Sweetwater Lake, North Dakota. They were taken June 11, 1900, from a nest of down and feathers, in a slight hollow of the earth, amidst a thick growth of underbrush extending out into the lake.

133. BLACK DUCK. *Anas rubripes*. 22 in.

The Black Duck, often called black mallard, black English duck and dusky duck, is similar in habits and size to our common green-head mallard, the latter, however, has a much wider range. The black duck is rare west of the Mississippi, occurring usually in the east from the Atlantic coast through the New England states, Quebec, Ontario and along the east coast shores of Lake Michigan.

They are among our slowest flying ducks, traveling about forty-five miles an hour, while teal and canvas-back ducks attain a speed of one hundred miles an hour. Unlike most ducks the plumage of the sexes is similar.

The black duck often interbreeds with the common green-head mallard, but are less popular than the green-head as a game bird. The female quacks, and the male utters a low nasal note. These birds usually inhabit

shallow water, open marshes, little streams and small fresh-water lakes. The winter range extends along the coast of Florida, the Gulf States and the waters of Mexico.

While breeding usually north of the United States, they are fairly common in the wet sections of Maine. Seven to twelve eggs are laid, varying in color from pure white to light green. The nests are placed in grassy spots close to the water, and lined with a liberal amount of dark down.

139. GREEN-WINGED TEAL. *Nettion carolinense*.
14.5 in.

The Green-Winged Teal ranges throughout North America, breeding from Minnesota northward, wintering from Kansas and Virginia southward to West Indies and Central America.

In size and general appearance this duck so closely resembles the blue-winged teal that one plate on "Study" answers for both. The main difference is in color of speculum, or bright patch on wing; the habits too are similar.

The range of the green-winged is more northerly than that of the blue-winged, which frequently nests in the central parts of the United States. The green-winged is one of our handsomest fresh-water ducks. It is capable of flying with the wind at a speed of one hundred miles an hour, the wings making a loud whistling noise. They feed in shallow water or wade about the shores of our inland ponds and lakes. Being practically surface feeders and living often on wild grass seeds of the marshes, their flesh is second to that of no other duck in tenderness and flavor.

The green-winged remains in the Great Lakes region until the waters freeze, when our handsome blue-winged is many hundred miles farther south. It also reappears in the spring several weeks in advance of our other teals. The northern portions of central Canada are the favorite breeding grounds of this beautiful duck. Occasionally, however, it remains in the famous wild fowl region about Devil's Lake, North Dakota.

The writer has ten pale ashy green eggs taken in North Dakota from a nest which was in a tussock of coarse grass on dry ground, but close to the water's edge.

141. CINNAMON TEAL. *Querquedula cyanoptera*. 15 in.

Cinnamon Teals range more southerly and westerly than our other teal. The flight of the Cinnamon teal is probably more rapid than that of other water fowl except the canvas-back and blue and green-winged teal. These birds are prized by epicures, but fortunately they prefer mild climates, and many of them leave the haunts of the sportsman before the opening of the game season.

The males are beautiful birds, having plumage unlike that of any other water fowl. Cinnamon teals are found on both fresh and salt water, but retreat to clear pools and streams to breed. They breed commonly in California and the Salt Lake region of Utah. The nests are placed on dry ground, usually in a thick clump of grass; six to twelve cream-colored eggs are laid from May 1st to June 10th.

143. PINTAIL. *Dafila acuta*. 28 in.

The Pintail ranges throughout North America, breeding from Iowa and Illinois to the Arctic ocean; wintering from Virginia southward to the Greater Antilles and Central America.

The gunner's sprig or spike tail is not easily decoyed, being always suspicious of men. The pintails arrive in the middle states with the first spring thaw, often late in February. They are strong fliers, frequently covering eighty miles an hour. Fresh water ducks and feeding in shallow places by dipping or dabbling, their mode of feeding would make them highly palatable were they inclined to fatten, but one rarely finds a fat pintail. The female has a distinct low quack. They move about with some ease on land, appearing less awkward than most ducks.

The pintail resorts to the prairies of Minnesota, Da-

kota, and Western Canada to breed. The nest is on a dry spot sometimes a mile from water. The female scratches a hole in the earth and the eggs are deposited on a lining of dead grass, accompanied by a generous amount of down from the parent's breast. Eight to eleven pale ashy green eggs are laid. The young are led to the water by the parent as soon as they emerge from the shell. Occasionally this bird nests on the lonely prairie of Iowa, Illinois and Nebraska.

142. SHOVELLER. *Spatula clypeata*. 20 in.

The Shoveller, or Spoonbill, is a bird of wide distribution, inhabiting all the continents and breeding in the northern portions of both hemispheres. It is a bird of striking individuality. The remarkable bill, the distinguishing feature, broadens at the end until it exceeds twice the width of the base, and assumes a spoon shape. Like other pond and river ducks, it is most abundant about fresh water.

It is a common summer resident of Minnesota and the Dakotas, thence it ranges northward through Manitoba, Assiniboia and Alberta. During their semi-annual passage through Illinois small flocks of shovellers are frequently seen on the Illinois and Kankakee Rivers and on Lake Calumet. Usually they arrive from the south in March and by April the majority have paired, and soon move northward. In September and October its southern migration takes place to southern United States, it may occasionally be found in Cuba and South America in December and January.

Sportsmen do not look on this duck with the same pride that they feel for a "bag" of canvas-backs or teal; yet the flesh of the spoonbill is considered delicious.

The female's note bears a resemblance to that of the mallard, an oft repeated "quack." It retires in May and June to the lakes and marshes, chiefly those of the interior, to breed.

For nests and eggs see Chart XXV.

144. WOOD DUCK. *Aix sponsa*. 18.5 in.

The range of the Wood Ducks is quite extensive, covering temperate North America from Florida to Hudson Bay.

"Few if any more exquisitely beautiful creatures have been fashioned in the workmanship of Nature, than the Wood Duck of America," are the words of Dr. Dawson, and to them we might add the words of Mr. Chapman, "Woodland ponds and various border streams make a proper setting for the grace and beauty of this richly attired bird." They do not quack but have a pleasing and musical call, a sort of whistle.

These birds perch upon branches of trees, and are fond of acorns. They are not solely dependent upon aquatic plants and animals or even upon food which is found upon the ground, but also eat flying insects and young buds.

It seems too bad that because of unscrupulous hunters this gem of the woodland should be in danger of extermination. Then too, the open season for ducks does not offer protection, as the hunting season opens before the southern flight of most water fowl which nest in the far north, has begun. Therefore, our summer ducks are for a time the only available game.

They build their nests and seek their food in unfrequented woods near the water. Favorite nesting places are hollow branches of trees, an old woodpecker's hole, or hollow stump, preferring holes that overhang the water or are near it. They will, however, often accept sites away from the water, in which case the parent removes the young in her bill to the water as soon as they are hatched, but the young do not return to the nest. The writer has eight eggs taken at Long Lake, Minnesota, May 21, 1903. The hollow tree in which the eggs were laid was profusely lined with down and feathers.

4. SEA DUCKS.

137. BALDPATE. *Mareca americana*. 19 in.

The Baldpate ranges throughout North America; breeding in the interior from Minnesota northward, wintering in Central America and northern South America.

The baldpate, or American widgeon, is a common spring and fall migrant in the Mississippi Valley. Though less popular and conspicuous than many other game birds, it is a delicately marked species.

The habits of these ducks are similar to those of the gadwall and teal; they enjoy mud flats and grassy ponds, feeding on vegetation, aquatic insects and molluscs. Especially fond of wild celery but not good divers, they often procure it by snatching morsels from canvas-backs and other diving ducks, the instant their heads appear above the water.

On June 18, 1900, while searching in the buck-brush on the bank of Sweetwater Lake, N. D., the writer flushed a female baldpate from a nest of nine beautiful flesh-colored eggs, well hidden in a quantity of down and leaves.

146. REDHEAD. *Marila americana*. 19 in.

The Redhead looks like a canvas-back and is often mistaken for it, the difference is shown principally in shape of bill and upper head. (See plates.)

The redhead, or porchard, is one of our gamiest ducks, occurring throughout temperate North America, chiefly from the Great Lakes region westward. These ducks arrive from the south early in March on the way to Dakota and Manitoba, where they are comparatively abundant.

The redhead decoys easily, but frequently feeds in large expanses of open water where the hunter is afforded no opportunity to approach within gun-shot. The writer quotes the following from his article on "The Nesting of the Redhead Duck":

"They are very aquatic in their nesting habits, more so than any others of their family, except the canvas-back or ruddy duck, in whose company they are often seen dur-

ing the breeding season. I discovered fifteen nests during one June in the Devil's Lake region in North Dakota. These nests were placed in tall grasses or reeds growing in water from one-half foot to three feet deep. In no instance were the eggs placed on the ground. The dry grass is massed together forming a float, upon which the nest of practically the same material is placed. Frequently the birds construct a floating nest. It is a beautiful sight to observe the female as she leaves her nest uttering a soft quack as she paddles out of sight among the tall grass."

Ten eggs taken June 3, 1900, were placed in a large nest containing $1\frac{1}{2}$ ounces of feathers and down, plucked from the breast of the parent bird. The down serves as a means of incubation during the duck's absence.

See Chart XXV.

147. CANVAS-BACK. *Marila valisneria*. 21 in.

Few game birds are more celebrated than the Canvas-back; sportsmen and epicures find that it meets their ideal of game qualities. It flies rapidly and with directness, dives quickly, swims rapidly, and is remarkably wary and alert, while its flesh is considered incomparably delicious by many, especially if the bird has been feeding on the "water-celery," an abundant fresh-water plant, and its favorite food.

The Canvas-back is peculiar to North America. Its nearest foreign relative is the red-crested porchard of Europe and Asia. The abundance of this noted game bird in the temperate regions is governed chiefly by the amount of water and the amount of "water-celery" found in any locality. It frequents both the Atlantic and Pacific coasts during migration, but confines itself to the interior while breeding. It is rarely found in northern Illinois and Indiana, although a number of them have been taken at English Lake, Indiana, Fox Lake, Illinois, and also at Lake Koshkonong, Wisconsin. A few males were also observed by the writer at Chillicothe, on the Illinois River. Its favorite food grows in all these waters.

The canvas-back is fairly common throughout the Devil's Lake region of North Dakota, where it nests with the redhead among the grassy sloughs and pot-holes, or on the borders of marshy lakesides.

One of the first duck's nests the writer ever found was that of a canvas-back, while searching for American bittern's eggs, in the latter part of May, 1900, near Sweet-water Lake, North Dakota.

The nest, about the size of a bushel basket, but with a much smaller capacity, was securely anchored to several large clumps of marsh grass, over water several feet deep. It was a bulky affair, consisting of dry grass and hay, sparsely lined with down and feathers. An incomplete set of four fresh eggs in the nest were partly concealed by the wary female which had attempted to cover them with down.

In Northwest Canada, the canvas-back nests abundantly in June, when it deposits from seven to twelve deep ashy green elliptical eggs. Incubated eggs of this species, like the eggs of other northern ducks, are usually surrounded by a quantity of down, plucked from the female's breast. The down of the canvas-back is much darker than that of the redhead, the latter having a grayish white down, and the canvas-back's being slaty gray or mouse-color. See Chart XXV.

A single nest is frequently found containing eggs of both canvas-back and redhead, but usually only one duck sits on the eggs.

149. LESSER SCAUP DUCK. *Marila affinis*. 16.5 in.

The Lesser Scaup, Little Black-head, Little Blue-bill, Creek broad-bill, Raft-duck, and Flocking-fowl, are some of the numerous names applied to this species. Three varieties of scaup ducks inhabit North America, the greater scaup, the lesser scaup, and the ring-necked scaup. When migrating, the lesser scaup frequents both fresh and salt water, but during the breeding season it is usually seen in the interior.

In general appearance and habits this duck resembles the great scaup, but averages one and one-half inches shorter. In many localities it is the most abundant duck, this is true of the Calumet region of Northern Illinois and Indiana. The little scaup furnishes royal sport to the gunners, especially during October and April, being easily decoyed.

Many lesser scaups, especially the males, linger on Lake Michigan, six months in the year; in fact, this bird has been recorded monthly from January to December.

The scaups are expert divers, often descending forty feet below the surface for their food. When pursued, wounded birds have been known to dive among aquatic plants, and close their bills on some reed, remaining there until dead.

Like the chimney swift, a trio of birds are commonly observed flying together, usually a drake and two females.

Like certain other ducks, the lesser scaups do not breed until they are two years old. This accounts for the appearance of lesser scaups upon southern Lake Michigan throughout the summer.

In Devil's Lake region of North Dakota the lesser scaup breeds, being a common summer resident, save while nesting it inhabits deeper water than other ducks, except the canvas-back and redhead. After June 1st a drake may be seen in company with several females paddling about in the grassy sloughs near nesting grounds. Scaups are partial to small islands which afford sufficient concealment for the nest. Six to eleven light olive green eggs are laid.

150. RING-NECKED DUCK. 16.5 in.

In habits and distribution the Ring-necked ducks resemble the Lesser Scaup but are less common. They may readily be distinguished from the scaups in two ways, viz:—ring-necks possess a very plain ring around the bill, and the upper parts of the ring-neck are black with a total absence of white, so conspicuous on the scaup.

151. GOLDEN-EYE. *Clangula clangula americana*. 15.5 in.

The Golden-eye, or "Whistler," and decidedly a deep water fowl, is a common winter resident on the Great Lakes and in the larger rivers. It occurs from coast to coast, but the Barrow's golden-eye chiefly replaces this form from the Rocky Mountains westward. A flock of golden-eye traveling with the wind at eighty miles an hour produces a sound with their wings from which the bird derives the name whistler. Feeding almost entirely on fish, they are not so good eating as are most ducks. These birds are expert divers, and are sometimes caught in nets which have been lowered into five fathoms of water.

During the spring, the golden-eyes retreat to the timbered lakes, near which each female selects a hollow tree, where eight to fourteen beautiful bluish green eggs are deposited. The writer found ten eggs fourteen feet from the ground, in the hollow of an oak on a timbered peninsula, jutting out into Devil's Lake, North Dakota. In passing I noticed little particles of down attached to the bark above the cavity. Inspection disclosed the incubating bird which refused to leave her treasures until touched.

153. BUFFLE-HEAD. *Charitonetta ableola*. 14.7 in.

This beautiful little duck known as Buffle-head, Butter-ball, or Spirit Duck ranges from the Atlantic to the Pacific, migrating in October to the gulf states and Mexico. A few remain in the northern portions of the northern tier of states, but the wild lakes of Ontario, Manitoba, and Alberta are the regions frequented during the nesting season.

It is the smallest of our deep water ducks, not abundant and seldom seen in large flocks. The large head of the males is covered with a crest of greenish blue and white feathers, which they raise and lower thus presenting a picturesque sight as they swim about on the water, diving with remarkable rapidity. Their flight is strong and rapid, making them a good mark for the sportsman.

Their food is principally fish and other small marine life, which they secure by descending into great depths of water.

Like the golden-eye, the wood duck, and the mergansers, the buffle-head deposits her eggs in hollow trees. It is remarkable how small an entrance will accommodate the female, which frequently uses the abandoned nest of a flicker. Light colored down is used to cover the six to nine ashy gray eggs, which continue to incubate while the parent is away.

165. WHITE-WINGED SCOTER. *Oidemia deglandi*.
22 in.

The Scoters are partial to the seacoast. Among the hunters they are known as "sea coots." Three scoters are common to the American continent, the other two are the surf scoters commonly called the surf duck, or patch-head coot, and the American scoter known as the butter-billed coot. The white-winged scoter inhabits both the Atlantic and Pacific coasts, and is found on the Great Lakes during the winter months.

The flight is slow and peculiar. The males are striking in appearance, with their glossy black feathers broken only by white patches on the wing and a small white patch above the eye; the iris is white, the bill yellow and red.

Large flocks of these birds congregate annually during the summer months among the outer islands of Casco Bay, Maine, but they have never been found breeding in this territory. This is one of the strongest evidences to many that the white-winged scoter's nesting habits are unknown because they disappear from regions where they are common except during June and July.

During these months they breed on large inland lakes in Canada and northern United States, especially in the Devil's Lake region of North Dakota as they seem to enjoy its alkaline waters. A peculiar characteristic is the southward flight made by these birds when they appear at Devil's Lake in June to breed, as they arrive direct

from the north to rear their young in the treeless tracts of the Dakotas.

The nests are usually slight hollows in the earth under a tussock of grass or a small bush on dry ground where the lake forms a hard shore.

167. RUDDY DUCK. *Erisaetura jamaicensis*. 15 in.

The Ruddy Duck is distributed generally from northern South America to Hudson Bay, breeding mostly in Canada, though locally farther south. This duck is more common west of Indiana and Michigan. In the Great Lakes region they are known chiefly as migrants, but in Utah, Colorado and California this odd-looking duck is a summer resident. They frequent both fresh and salt water, flying low over the surface.

Ruddys are comparatively small ducks with flat bodies and stiff tail feathers held erect while swimming. The feet are extremely large and the birds swim rapidly both under and above water. In rising it runs on surface of water against wind.

Like the redhead and canvas-back, this bird constructs a floating nest from which the parent quickly swims at the approach of danger. The eggs, six to twelve in number, are immense for the size of the bird, even exceeding those of the large mallard and canvas-back. The granulated shell lacks the oily polish found on most duck eggs.

172. CANADA GOOSE. *Branta canadensis canadensis*. 40 in.

The Canada Goose ranges throughout temperate North America, breeding in the west on the ground or sometimes in trees near streams.

This is the typical wild goose, and in the estimation of many sportsmen the wariest and gamiest of the feathered tribe. In the fall and early spring large flocks of these geese may be seen moving slowly overhead; it is the general supposition that these "honkers" are on the way north or south, but they are much hardier than we generally suppose. Many Canada geese winter about Lake Michigan,

spending the day far out in open water where there is no danger of molestation. At sundown they rise in V-shaped flocks and move inland to feed in grain fields.

Because of its intelligence, the Canada goose gives promise of holding its own despite the increase of gunners. It would be a shame to lose this picturesque and stately bird, as the United States can now claim few as summer residents, while fifty years ago it was with us twelve months in the year.

In 1900 while collecting in North Dakota I unexpectedly chanced upon a pair of these birds leading five downy young across the prairie not far from open water. I hastened toward the group, when the old birds rose and flew toward me flapping about my head in a threatening manner; a bird with such strength of wings is capable of putting up quite a fight. As I stood watching the antics of the old, the goslings reached the lake and swam rapidly from shore. It was an impressive sight to see these two naturally shy birds so fearless of man in their efforts to protect their offspring.

Many geese do not breed until they are two years old, which fact may explain the presence of small flocks in breeding season in temperate regions where they are not known to nest. I have six large white eggs of the Canada goose taken in Illinois some years ago when a few still nested along the Mississippi. The nest was placed on the ground at the edge of a little pond not far from the "Father of Waters."

On the Lakes of Manitoba, these birds construct their huge nests on the islands in company with herring gulls and cormorants. The nests are composed of weeds and debris, warmly lined with down from the breast of the parent.

180. WHISTLING SWAN. 55 in.

Whistling Swans are the largest American representatives of the duck family. Like the whooping swan the plumage of this species is pure white, the greatest difference between the two varieties being the note. Both

appear in high altitudes, migrating south in winter through the Mississippi Valley and Great Lakes region. The development of the neck is remarkable, probably more noticeable than that of any other American bird. Swans feed chiefly when floating in shallow water, as their strainer bill may reach by means of the long neck the plants and animal forms lying at the bottom.

5. WADING BIRDS.

Flamingoes are tropical birds. Of the seven species included in the order only one reaches North America. Flamingoes are gregarious throughout the year. Feeding in shallow bays or mud flats they are rarely found far from the coast. They feed similar to ducks, having same strainer nature of bill.

Spoonbills are mostly tropical birds, only one species inhabiting the United States. They are gregarious, nesting in colonies. While general habits resemble those of the herons, they immerse their large flat, sensitive bill and feed by swinging it from side to side.

Ibises are usually tropical birds. Of thirty species only four are to be found in North America. These silent, gregarious birds feed along the shallow lagoons, bays and mud flats, usually of salt water. The peculiar bill is adapted to taking and crushing crustaceans; it also eats frogs, small fish and reptiles.

Hérons and bitterns have a general distribution though they are most numerous in the tropics. Herons are gregarious, even when they feed singly they nest and roost in flocks. Bitterns are usually found singly or in pairs. They select grassy marshes for feeding, while herons prefer the shores of sea, lake or river. Protective attitude and color of bitterns are marked. Some herons await their prey in shallow water, while others run through water and carry on an aggressive campaign, spearing frogs and fish as they attempt to escape. Herons fly with neck arched over shoulders.

Which kind of food of these birds make them useful and which harmful to interest of man? What of nature of bills? Explain way herons and bitterns use the bill. Why may it be considered a spear? When legs of a bird are long what of neck? Why? What kind of bill has the flamingo? Why is it used as a hoe instead of a spade as is a duck's bill? How does the spoonbill use its bill? The ibis? The flamingo may be regarded as a "connecting link" between what classes of birds? Feet and bill tend to place it with which class? Legs and neck? Mention other connecting links. What protective position and color of bittern? Of least bittern?

182. FLAMINGO. *Phœnicopterus ruber*. 60 in.

Flamingoes are tropical or sub-tropical birds distributed throughout favorable sections of the Atlantic coast of both hemispheres. Five varieties are American, only one of which reaches North America. They are gregarious birds and are to be found in colonies during both the breeding and migrating seasons. Showing a decided preference for still and brackish water, one seldom encounters these large birds far from the seacoast.

The construction of the strainer bill is peculiar, the portion joining the head is almost at right angles with the outer half of the beak. The beak of the young is straight like that of a duck, gradually assuming an angle. Their mode of separating the edible matter from the waste is the same process used by ducks, but of course the latter pushes the bill forward as a spade, while the former uses bill more as a hoe because of long neck.

The plumage is light salmon, bordering on pink or light rose. The feathers on some parts of the body are lighter. In confinement and in mounted specimens the plumage loses the bloom so that the feathers become several shades paler. This undoubtedly is due to the lack of some essential article obtained in the natural diet when in the wild state.

These birds nest in the islands south and east of Florida. Extensive mud flats slightly flooded at high tide are the

favorite nesting grounds. Scraping together a quantity of the wet earth until there is an elevation of from six to twelve inches, it is slightly hollowed at the top but not lined. While incubating her single egg, the female folds the legs under the sides as do other long-legged birds, thus dispelling the popular belief that the flamingo sits astride her nest.

The long, white or pale greenish white eggs have the surface so thickly coated with soft lime that the chalky substance is left on the hand when handling specimens.

Occasionally these birds in their wanderings touch the extreme southern coast of Florida, but they do not breed on that peninsula.

183. ROSEATE SPOONBILL. *Ajaja ajaja*. 32 in.

These beautiful aquatic birds are found both on the coast and in the interior. Of the half-dozen varieties of spoonbills, the Roseate Spoonbill is the only form inhabiting North America. Their range is becoming more restricted yearly. Years ago the species occurred in southern Illinois and Indiana. About the only section of the United States where this bird is now found in any numbers is along the gulf coast of Texas, ranging from there southward into South America. The principal cause for the extinction of this species in most of its former range is beauty, the same cause that led to the fate of the snowy herons, slaughtered for the "aigrettes."

Like our large herons they are gregarious, but their mode of feeding is entirely different from that of our other American birds except the avocet. They feed by swinging the bill from side to side through the water; the edges of the sensitive mandibles recognize the nature of substances touched, so that the bird finds food in muddy water.

In former years the spoonbills nested in large colonies in various swampy places in Florida. A large bulky structure of sticks is usually arranged by the birds in small shrubs and little trees growing in or near the water.

Three or four eggs are usually laid, the background being white and the markings light brown.

184. WHITE IBIS. *Guara alba*. 25 in.

The White Ibis resembles the ancient sacred ibis of the Nile, while in habits it resembles the heron, crane and bittern. Inhabitants of warm climates, in America their range is becoming restricted yearly. Four varieties occur in North America, the wood ibis and the white-faced glossy ibis like the white ibis are peculiarly American, while the scarlet ibis is an accidental visitor. Some years ago the white ibis was found in the southern swamps of Illinois and Indiana. Of late years they have retreated to the wooded sections of Florida, Texas and other gulf states.

Ibises are gregarious, but unlike the herons and cranes are almost silent birds. Their food is chiefly animal matter, such as frogs, crawfish and minnows. Their large beak is well adapted for extracting and crushing crawfish.

The flight of the white ibis like that of the white pelican is picturesque. They move in close ranks alternately flapping and sailing, all birds moving the wings simultaneously. As they pass through the sunlight, the plumage glistens, and the black markings on the wing show in marked contrast to the otherwise immaculate plumage.

Their nests are placed in low thickets, frequently above the water. Like the nest of the heron it is a rude affair of sticks and moss, arranged in the form of a platform with a slight depression in which three or four bluish white eggs are laid. The eggs are heavily blotched with scarlet, but the markings appear somewhat smeared giving the eggs a dirty appearance.

190. BITTERN. *Botaurus lentiginosus*. 28 in.

The Bittern ranges throughout temperate North America, and winters from Virginia south.

One of the most familiar marsh birds it is known under many aliases, such as thunderpump, Indian hen, stake driver and bull goose. This interesting creature is not

a game bird, but because of its sluggish nature is often the victim of the ruthless hunter. To escape detection, bitterns assume a pose extending the head and neck skyward, thus resembling a stump with a dead sprout at the side. Bitterns stand motionless for hours in shallow water, until some fish, frog or reptile comes within striking distance.

This bird breeds commonly throughout the east and middle west, from New York, Illinois and Iowa, northward. The nests are usually composed of dead reeds and rushes, a mere platform with little or no cavity. From three to six eggs are laid, and the period of incubation is twenty-one days.

During the mating season the birds produce a remarkable vocal sound, not unlike that produced when driving a stake with a hammer. This performance has earned them the title of "stake-driver." The notes are something like this: "Quack, chunk, chunk, quack, quack-alunk, chunk, chunk, quack um chunk, quack, quack-alunk chunk."

One excited female bittern disgorged eleven crawfish and seven frogs before I could persuade her to vacate her nest, which contained five coffee-brown eggs.

191. LEAST BITTERN. *Ixobrychus exilis*. 13 in.

The Least Bittern ranges throughout temperate and tropical North America, wintering south.

This beautiful bird is of a retiring disposition, though not averse to living in a noisy environment provided it is unmolested in its home among the tall grasses and rushes of marshes. Several authors speak of the least bittern as a "silent bird," although the writer has frequently seen and heard it utter a peculiar "squeak," especially if suddenly approached. It loves to lurk in the reedy borders of boggy ponds and marshy lakesides where gallinules and rails abound. An interesting habit of this bird is that of perching on an upright reed where with its neck extended it remains motionless, closely resembling in color and form a bunch of dead reeds, in order to escape de-

tection. While pushing my boat among the rushes during a rainstorm, I once saw a least bittern roosting in a clump of vegetation, with its head drawn between its shoulders, oblivious to its surroundings. I gently touched it when "Rock, rock!" it seemed to call, and in its sudden efforts to escape, lost its equilibrium and fell into the water.

Its nest of grasses, etc., is placed among reeds or in a small bush, three to six bluish white eggs are laid.

194. GREAT BLUE HERON. *Ardea herodias herodias*.
48 in.

The name Great Blue Heron, often called Blue Crane and Sand Hill Crane, is misleading as the prevailing color of the adult is slaty gray.

This bird is found from the Atlantic to the Pacific, breeding in colonies north of the Ohio River, throughout the Great Lakes region and the Canadian Provinces. It winters from Middle States southward to northern South America. River bottoms and tamarack swamps are resorted to immediately upon their arrival from the South in April. The birds travel great distances to fish, usually singly. Unlike the bitterns, herons do not stand motionless waiting for their prey to come within reach, but move about in shallow water, striking with their bill any form of animal life that appears near the surface.

Their notes are coarse discordant croaks. This species is not suffering destruction at the hands of the plume hunter, so are still found in great numbers along the river bottoms of the Kankakee and the Illinois.

Places where they assemble to nest are called "heronries." Some huge trees contain as many as forty nests, all of which may be occupied at the same time; the ground or shallow water beneath these nesting trees is offensive with decaying fish.

The trees occupied by the nests usually die after the second or third year, but the nests are used after the trees are dead. The three to five light blue eggs require four weeks incubation, and the young leave the nest after sixty or seventy days. In some of our treeless sections, these

birds have adapted themselves to conditions by constructing huge nests on the ground. The writer saw a colony of about two hundred pairs along the Yellowstone River in Montana and several other heronries exist on the barren alkali tracts of California.

197. SNOWY EGRET. *Egretta Candidissima*. 23 in.

The Snowy Egret, known also as the Snowy Heron and Lesser Egret, is now confined almost exclusively to the swamps of the southeastern United States. The bird was threatened with extinction until recent national laws were enacted prohibiting the killing of any American birds for plumage for millinery purposes. Only a generation ago the "snowy herons" were so abundant that the trees of southern marches sometimes glistened like snowdrifts with flocks. Frank Chapman says of this bird: "The 'curse of beauty' has numbered the days of this the most dainty and graceful of herons. Now it is the rarest of its family. The delicate 'aigrettes' which it donned as its nuptial dress were its death warrant. Woman demanded from the bird its wedding plumes, and man has supplied the demand. The Florida herons have gone, and now he is pursuing the helpless birds to the uttermost parts of the earth. Mercilessly they are shot down at their nesting grounds, the coveted feathers stripped from their backs, the carcasses are left to rot, while the young in the nest above are starving." This species is decidedly gregarious. In former years the range of the "little white heron" was more extensive than now, and they were not uncommon along the Ohio River Valley. It is encouraging to note that during the past three years (1914) they have increased rapidly on the protected bird reservations of Louisiana, Florida and Georgia. Frequently the little blue and the Louisiana herons and the snowy egret were found occupying the same shrub among the cypress of the Everglades.

Like the bitterns and other herons there is an absence of feathers along the back of the neck. This is not noticeable except on close inspection, as the other neck feathers are long. The bird may be identified by the pure white plumage and black bill and legs.

The eggs of this species, like those of the other herons, have the characteristic blue tint, yet there is a suggestiveness of green. Four eggs are usually laid. The ends of each egg are of similar shape. A considerable deposit of lime occurs on many of the eggs, as is true of all herons. The nests are frail structures, barely deep enough to contain the eggs, which are deposited in April. The young are fed by regurgitation, and they leave the nest the fourth week.

200. LITTLE BLUE HERON. *Florida carulea*. 22 in.

The Little Blue Heron is found from New York, Illinois and Kansas, southward through Mexico and Central America to South America and the West Indies. It is of accidental occurrence as far north as Maine and Wisconsin.

The name "little blue" is somewhat misleading, as adult birds are a maroon color on the head and neck, the rest of the plumage is grayish or slaty. Immature birds are pure white with the exception of a faint grayish tinge near the tips of the wings. The young, therefore, look very much like the snowy egret.

These birds often breed in company with snowy and Louisiana heron. Their eggs like those of all other herons are light blue unspotted. The nests are mere platforms of sticks. The writer has four eggs taken from a nest placed eight feet above the water in a willow, where yellow-crowned night herons were nesting in company with the little blue herons in one of the Georgia swamps.

201. GREEN HERON. *Butorides Birescens*. 17 in.

The Green Heron or "Fly-up-the-Creek," also called "Scheytepoke," "Poke," "Chuckle-head," etc., is probably the commonest of the North American herons; but, owing to its small size and disinclination to be sociable, is not so frequently observed as the varieties which breed in colonies. The birds spend the winter in Central and South America, migrating north in April to temperate North America, attired in lustrous green plumage that gradually loses its iridescence. They are chiefly found east of the Great Plains and north from the Gulf of Mexico to southern Canadian provinces.

Their only note is a decided "quack," characteristic of the herons. They are partial to shaded pools, timbered creeks and small lakesides. Occasionally they resort to orchards, half a mile from water, to nest and rear their young. Three or four pairs sometimes occupy one clump of willows, but usually they are found feeding and breeding in isolated pairs. When surprised at his work, he either arises with a frightened quawk and clears the tree-tops, with all haste or else alights to investigate the danger. Here he may nervously crane his neck and twitch his tail or "freeze" in a protective attitude. The birds feed exclusively upon animal life, such as frogs, crawfish and minnows; but as the season advances beetles and other insects with their larvæ are added.

The flight is slow and horizontal, with the neck drawn back between the shoulders, and the legs extended behind at full length. Because of the relatively large wings, the light body bobs up and down in a comical manner in flight.

The bird is a common visitor in the parks of Chicago, and several spend the summer about the lagoons.

The nests are at low elevations, usually not to exceed fifteen feet above the ground or water. They are almost flat and consist of dead twigs and coarse stems. The eggs are four or five in number and are laid in the last half of May, and the period of incubation is twenty-one days. The eggs are a light blue, with a slight greenish tint.

202. BLACK-CROWNED NIGHT HERON. *Nycticorax nycticorax naevius*. 24 in.

The Black-Crowned Night Heron, or "Quawk," breeds chiefly in the United States; it also breeds in southern Canada from New Brunswick to British Columbia, wintering from the Gulf States to South America.

This bird might more properly be called the bridled heron, as the males have two feathers four to eight inches long and scarcely one-tenth of an inch in breadth attached to the back of the neck. The name "black-crowned" is derived from the steel blue feathers on the head.

These birds are gregarious and move about both by day and night. As the sun is setting they may be heard

giving their noisy cries from which comes the name "Quawk," while moving slowly with deliberate wing-beats in single file like troops.

Black-crowned night herons like other night herons remain hidden by day in some secluded piece of timber preening their feathers. Herons are wading birds but are not very active, and seem contented in dry territory after satisfying their appetites with food, principally aquatic animals. Having favorite feeding grounds, they often travel twenty or thirty miles to feed in the same marsh.

A bird lover discovered a heronry of these birds in a growth of coniferous trees in Kankakee County, Illinois. The nests were placed so close together that it was possible to inspect the contents of twenty-seven nests without descending to the ground, some trees containing as high as fifteen nests.

Four to six light blue eggs are laid in a nest usually composed of coarse twigs arranged in the nature of a platform. While in the Devil's Lake region of North Dakota, I encountered these herons nesting in the treeless sections. The nests resembling those of bitterns, were built in dense reeds and rushes bordering fresh-water lakes. Black-crowned night herons breed chiefly in the United States from the Atlantic across the continent to British Columbia.

6. MARSH BIRDS.

The Crane family comprises eighteen species of large birds of which three are North American. They are omnivorous feeders, eating frogs, mice, snakes, insects, and some vegetable food found about marshes and plains. They migrate in flocks but at other times are more solitary. Because of large size and few eggs laid, and persistent hunting, they are rapidly decreasing in numbers.

Fifteen species of Rails, Gallinules and Coots inhabit North America. Rails and gallinules are not strictly

gregarious. Coots, however, are found in flocks. Rails seek safety by running and secreting themselves, flying only when pressed when flight is short, as they quickly drop back to cover, yet in migration their flight is strong. Gallinules are strictly marsh birds; coots are aquatic resembling ducks, but are distinguished by their white bill and lobed feet.

Phalaropes are found in the northern part of the Northern Hemisphere. They are peculiar in that the female is the larger and more brightly colored; the male does the wooing, constructs the nest, incubates the eggs and cares for the young. Although marsh birds, they are web-footed and swim with the ease of a duck.

Avocets are usually found in flocks, feeding in shallow water. The bills are sensitive enabling the bird to select its food even if water is muddy, as it swings the bill from side to side. Although it has long legs and bill it possesses webbed feet and swims with ease.

QUESTIONS.

Why the long toes of gallinules? How does avocet use its bill? What other birds have bills sensitive to the tip? While coots are waders in what respect are they like swimmers? What other birds of this chart VI are also swimmers? Do the phalaropes have webbed feet? Can they swim? How can you always distinguish between ducks and coots?

206. SANDHILL CRANE. *Grus mexicana*. 45 in.

The Sandhill Crane ranges from Florida and Georgia northward through the Mississippi valley to Manitoba, wintering in the Gulf States.

In America the cranes are threatened with extinction. Their conspicuous size and the fact that they are less prolific than most of our game birds account for the scarcity of this great wader. The sandhill crane is local in its breeding range. A number remain in the almost inaccessible swamps of Florida to nest; in all other states of

the Union the bird is of rare occurrence except as a migrant. One or two pairs have managed to run the gauntlet of the gunner, and still retire to open marshes along the Kankakee River in northern Indiana. A few pairs spend the summer in remote sections of Minnesota and the Dakotas. Of late years, however, northwest Canada has afforded more places of refuge for the sandhill crane and its relatives, the whooping and little brown cranes.

Cranes are less aquatic than other wading birds. They feed largely upon dry ground, hence their food is often obtainable in cultivated sections where the bird would no doubt thrive were it assured immunity by man, its worst enemy. The flesh of the sandhill crane is greatly esteemed among epicures, as it is not rank like that of most large wading birds, due to difference in diet.

Their nest is a huge mass of grass or hay arranged often in shallow water, but built so high as not to interfere with incubation. Only two, buffy brown, blotched eggs are laid.

In April and May during the mating and nesting season the cranes give vent to their feelings of passion in a most hilarious manner. The males indulge in performances not unlike an Indian war dance, flapping the wings and jumping into the air, alternately landing on first one foot and then the other. During the excitement the females participate and the show continues until the birds cease from utter exhaustion. They also have a soaring, circling, croaking flight at a great elevation. So loud is this croak that it may be heard after the birds have passed from sight.

208. KING RAIL. *Rallus elegans*. 15 in.

The King Rail, or Marsh Hen, breeds from northern Missouri to southern Connecticut, strays farther north, wintering in Virginia and Kentucky south.

This, largest of fresh-water rails, inhabits the reedy margins of bayous, ponds and inland marshes. East, south and west of the Great Lakes region it is replaced

by various forms of the clapper rail. The male and female are similar in plumage, while the young are covered with jet black down. The bodies of the rails are compressed, enabling the owner readily to pass through tangled vegetation, for which the feet and legs are remarkably well adapted, as with widespread toes they traverse the bogs and impenetrable swamps and quagmires with an unequalled agility, taking wing as the last resort.

Rails are less aquatic than coots or gallinules, and though not gregarious are seldom found in isolated pairs. Frequently several varieties of rail occupy their respective nests within a few yards of each other, and again all three species will deposit their eggs in a single nest, which is usually that of the king rail, the largest of the genera.

No one should be surprised at the antics of this bird. A neighbor discovered one in the front room after leaving the door ajar one morning. King rails have been observed about the barnyard in company with the poultry. On several moonlight nights between the hours of eight and ten, in May and June, I have heard and seen this droll looking bird strolling about the streets of Chicago, perhaps one-half mile distant from the nearest marsh. It ventures upon the sidewalk and poses under the light of a street lamp and suddenly becomes hilarious, calling, cackling, and creaking, its hoarse voice breaking the silence of the calm spring atmosphere, and then he vanishes as if by magic.

Ten eggs in the writer's collection were taken June 10, 1908, at Worth, Cook County, Illinois. The grass nest was placed at the base of a clump of grass, the top of which was naturally woven so as to form a canopy over the eggs. The nests are usually placed in shallow water, but this particular nest was on dry land close to a pond.

212. VIRGINIA RAIL. 9.5 in.

The Virginia Rail is one of the commonest American water birds. In habits and colors it closely resembles the king rail but is only one-third as large.

214. SORA RAIL. *Porzana carolina*. 8.5 in.

The Carolina, or Sora, Rail is the most plentiful of the family inhabiting at large the marshes and swamps of the east and middle west through United States and Canada to Hudson Bay, wintering from the Gulf States to northern South America. West of Missouri, Iowa and Dakota they diminish in numbers and occur erratically. In general structures and appearance the sora is very much like the gallinule. The bill is stout, the toes extremely long; and, though not webbed or lobed, the birds swim readily. The note is a high rolling whinny, uttered in the ascending scale, which note is taken up by other birds in the marsh and carried for miles.

They frequently inhabit more inaccessible swamps and marshes than the other rails, though the sora is less timid. They fly awkwardly with dangling legs over the marsh soon dropping into cover. Frequently a sora permits capture on foot rather than expose itself to a gunner by attempting flight. These birds, like the marsh wrens which inhabit the same cover, construct sham nests. They are sociable creatures, as two females sometimes deposit their eggs in the same nest.

In the Great Lakes region this bird arrives about the middle of April, and the duties of incubation commence as soon as the first egg is laid. The nests are loosely constructed of bulrushes and grass, well concealed in a clump of rank vegetation. Like the gallinule, the birds have a habit of constructing a little path or runway leading from the nest to the water's edge.

215. YELLOW RAIL. *Coturnicops noveboracensis*. 10.7 in.

The Yellow Rail inhabits both eastern and western North America from the Atlantic to the Pacific, ranging north to Hudson Bay and south in winter to the Gulf of Mexico. None of our other rails have a more extensive range. Comparatively little is known of this species because of its retiring habits and small size. They occur in many localities where their presence is not suspected. It

is almost impossible to flush the little birds; and unless one is acquainted with their haunts or can hunt them with a good bird dog, little opportunity is afforded the observer to form an acquaintance with it. Grassy tracts along coulees and prairie marshes are the haunts of the yellow crane, which avoids cattails and sluggish water more than do the other rails.

One observer was fortunate in discovering a little colony of these birds in North Dakota and by diligent watching located several pairs and ultimately discovered their nests, which were concealed in thick clumps of grass in open marshy places. Until these nests were located the eggs of the yellow rail were practically unknown to science. The six or more eggs are among the most beautiful found in North America; the background is a rich cream color having a cluster of minute purple and brown specks about the large end.

218. PURPLE GALLINULE. *Ionornis martinicus*. 13 in.

The range of the Purple Gallinule is tropical America to southern Illinois, wintering from Florida southward.

This brilliant bird is common to the Southern States. It is generally associated with the Florida gallinule, but is marked by more brilliant plumage.

"It has little of the aspect of a gallinule, but stands higher, and has its legs more forward. As it walks, the neck is alternately bridled up or thrown forward, and its short black and white tail is changed from a semi-erect to a perpendicular position, with a flirting motion. As this bird walks over the tangled leaves and stems of aquatic plants resting on the surface of the water, it moves with great deliberation, frequently standing still and looking leisurely about. Ever on the lookout for any danger that may menace it, at the least noise it hides among the rushes. Only when its place of concealment is invaded is flight attempted, when progress in the air is heavy and not well sustained. Its voice is loud and strong, but has in it nothing remarkable.

"Worms, mollusks, and the fruit of aquatic plants are its food. It gathers seeds and carries them to its beak with its claws, and it also makes use of them in clinging to the rushes, where the water is very deep." (Brewer.)

The nest is a platform of reed stalks built in rushes over water or in marshes; eight to ten eggs are laid.

219. FLORIDA GALLINULE. *Gallinula galeata*.
13.5 in.

The Florida Gallinule, or Rice-Hen, has a more extensive range than the name would indicate. While many of these birds remain in the Atlantic and Gulf States during the summer, the bird is found as far north as Massachusetts and Maine, and westward along the Canadian border to Minnesota. In the Middle States west of the Mississippi River, their appearance is somewhat erratic, though they abound in certain localities in Ohio, Michigan, Indiana and Illinois. The Calumet region near Chicago is a favorite summer home. They show a preference for stagnant water surrounded by cattails and bulrushes.

Gallinules sometimes appear as a "connecting link" between rails and coots. I have observed the king, Sora and Virginia rails with the coot, nesting near to gallinules, and noted a striking resemblance between the gallinules and some rails; for instance, the sora with its compressed body and widespread toes always reminds me of a small gallinule. Both swim about among the rushes, and I noticed that one sora deposited her eggs in a gallinule's nest.

Like the coot the gallinule often breeds in colonies. Some nests are built in clumps of dead rushes, and float upon the water in a manner similar to that of a grebe. Other nests are suspended a foot or two above the water, and are handsomely woven with blades of grass and rushes. When the nest is completed, a pathway is constructed of the same material that is used in building the nest proper, and forms a runway extending from the nest into the water. This is a characteristic which immediately distinguishes a gallinule's nest from that of a coot.

The number of eggs range from seven to fourteen. I have eleven eggs taken May 28, 1902, at Worth, Cook County, Illinois. The nest was built of sedges and rushes fastened in a clump of same over water three feet deep on the border of a pond.

221. COOT. *Fulica americana*. 15 in.

The Coot, or Mud Hen, ranges throughout North America to Alaska, being rare on the Atlantic coast, but abundant about marshes in the Mississippi valley; it ranges south in winter to the Gulf States.

The coot is one of the connecting links between waders and swimmers, partaking of the habits of our rail and gallinules, but is more aquatic than either. The feet, like those of the grebe, are lobed, enabling the bird to walk on floating vegetation and over soft soil with great ease and to swim more readily among reeds, etc. This bird is not really a game bird but is legally regarded as such. It fills the bag of many would-be sportsmen who are unable to shoot ducks or more palatable game. Coots are fairly abundant throughout the United States and southern Canada. Over the northern tier of states into Ontario and Manitoba, the mud-hen summers in great numbers.

This is our only marsh bird with a white bill, thus serving as an infallible field mark. When swimming the birds accompany each stroke of the foot with a nodding of the head similar to the movement on land of our semi-domesticated dove or pigeon.

The nests are beautifully constructed of dead rushes and especially grass. These receptacles are deep and are cleverly woven to living vegetation over water from six to thirty inches deep. The nests rise and fall with the water so that the birds have no fear of floods.

The eggs have a decided clay color dotted all over with minute specks of dark brown or black.

224. WILSON'S PHALAROPE. *Steganopus tricolor*.
8.8 in.

Of the three Phalaropes inhabiting North America, this is the only one peculiar to this continent. Their range extends across the United States and southern Canada from the Atlantic to the Pacific, much more common in the interior. They breed from northern Illinois and Utah northward, wintering south to Brazil and Patagonia. An extremely interesting species, it feeds principally in shallow water either by wading or swimming. The feathers on the breast are long and compact, and the birds are just as immune from the water as are our more aquatic ducks and gulls. One of the most beautiful sights in the prairie regions from northern Illinois through Minnesota and North Dakota is a number of these graceful creatures floating buoyantly in a shallow pool.

The females are by far the handsomer, slightly larger than their mates and handsomely though delicately colored. While looking for the nest, the bird student is not deceived by these reversed conditions, so characteristic of the species. Naturally the dull-colored bird among all other American species, where a difference in plumage is noticeable, assumes the household duties. Therefore the uneasiness of the little inconspicuous male phalarope conveys the idea that we are trespassing upon the breeding grounds. The handsome female deposits her eggs in a nest which has been constructed by her mate. It is composed of dead stems placed in a hollow underneath a tuft of grass, or at times a large bulky structure is arranged on top of the damp soil just above high watermark.

The female after laying the eggs usually joins others of her sex, and they move leisurely about the country feeding on mud flats or wet meadows until they become extremely fat. They do not join the males or young until time for the southward migrations in September.

The note of the phalarope is a beautiful little "honk" with a nasal twang to it. I discovered a small colony comprising less than a dozen birds early in May, 1911. They were occupying a slough near a body of fresh water. It

was necessary to climb a fence before entering the nesting grounds. This was a signal for the little colony to rise simultaneously and fly back and forth over the marsh with slow deliberate wing-beats. When directly overhead the males would poise momentarily and utter soft mellow notes of protest. Each note was emitted apparently with some effort, causing the bird to check its flight and throw the head backward.

The only way I succeeded in locating the nests was by watching the males through my fieldglasses from a distance. Presently each poised as a black tern is known to do just over the nest. Frequently the first setting of the phalarope is destroyed by an overflow. A second setting is then laid, consisting usually of only two instead of four eggs.

The eggs are clay-colored decidedly and handsomely blotched with umber brown and black, particularly at the larger end. The young when hatched are covered with a coat of chestnut brown, and are led about by the male for about two weeks before they can fly.

Wilson's phalarope is local in its habits and is becoming rare in the Great Lakes region. It seems hard to realize the reports furnished by Mr. Nelson, the first ornithologist of record for northern Indiana and Illinois. He reports in 1876 that the little phalarope was then the commonest of our small waders, outnumbering even the spotted sandpiper and killdeer.

225. AVOCET. *Recurvirostra americana*. 16.5 in.

The Avocet ranges throughout temperate North America, wintering along the Gulf coast and southward.

The avocet is outwardly unlike other American birds; the bill is recurved and, though a shore bird, the toes are webbed. The bill is so soft and pliable that one may wind it several times about the finger. While wading rapidly and with bill touching bottom, the bird swings this bill from side to side as a mower a scythe, thus enabling the bird to feed in muddy water. These birds grow less common from the Mississippi to the Atlantic. Their

favorite haunts are small inland lakes in the prairie districts from Colorado and Nebraska northward into Canada, breeding in numbers about the alkali waters of the Salt Lake region.

By some observers their call is described as the "bark" of the avocet. They wade into the water up to their breasts and, if progress on foot is difficult, they swim buoyantly about after the manner of our phalaropes.

The plumage has a beautiful pinkish cast about the head, neck and breast. Individual birds differ considerably in plumage and size of bill. The wings show less development than those of most waders.

Probably no other wader is more closely feathered underneath than this species. The covering resembles that of our gulls, which explains the bird's ability to alight in deep water and swim about without wetting the flesh.

Four buffy brown, black-spotted eggs are deposited in a little depression close to the water's edge. The birds are not close sitters but manifest an uneasiness at the approach of man.

7. SHORE BIRDS.

Snipes and Sandpipers are generally distributed throughout the world, breeding particularly in the northern part of the northern hemisphere, forty-five species being found in North America. They are shore birds and are seldom found far from water. While gregarious in migration, they do not nest in colonies. Their long bills, some of which are sensitive, are used as probes, while the woodcock moves the upper mandible by curving the point downward, the better to extract worms from the earth. While not song birds, some of them have a short musical note at nesting times. Although small they are favorite game birds.

Eight species of plover are found in North America. They have a general resemblance to the true snipes, but

have shorter bills and are not fitted for probing, as they obtain food from the surface of the ground. In feeding habits some plovers resemble the grouse. All shore birds are powerful fliers and perform extensive migrations. They possess pleasing call notes or whistles. Economically the group is useful, both because they are game birds and because of the nature of their food.

QUESTIONS.

What is peculiar about the bill of the woodcock? The position of the eye? Why is it so placed? What of size of eye? Does this indicate a diurnal or nocturnal bird? What other birds on this chart have sensitive bills? What of color protection of the woodcock? What of color protection of other birds of chart 7? Account for some of the names of the spotted sandpiper.

228. WOODCOCK. *Philohela minor*. 11 in.

The Woodcock ranges throughout eastern North America, north to Labrador, breeding throughout most of the range, wintering from southern Illinois and Virginia southward.

The woodcock is a delight to the sportsman. When the drizzle has partly taken the frost out of the ground and we are experiencing twelve hours of daylight, the woodcock returns to the Mississippi valley and the Great Lakes region, migrating by night. Those who know how and where to look for him are conscious of his presence when they visit the willow patches along lakesides or tramp through the hazel, which leads down to a springy spot. In these places the woodcock or "owl among snipe" may be found probing the soil with his long, sensitive, flexible bill. He feels the contact with a juicy worm, and cleverly moves the upper mandible thus extracting the morsel from the soil. The eyes are placed far back on the head, giving the bird great visionary power while probing.

Woodcocks are gluttons, consuming twice their own weight in twenty-four hours. Another habit is that of beating the earth with their feet, sounding like the patter

of rain. This noise brings the earth worms to the surface where they are captured.

The song-flight of the woodcock begins shortly after his arrival from the South and may be heard well into the warm summer nights of June, when the bogs are so infested with mosquitoes as to make life unbearable. The proper time to see the woodcock perform is during the cool nights of April when the birds are breeding.

I visit the moist places immediately after sunset, where during the daytime I have flushed woodcock or observed perforations among the soft leaves. Presently a short nasal call comes from the underbrush. It is suggestive of the nighthawk's call. After locating the bush under which the "speaking" takes place, there is a rustle of wings and a bird rises in circles. The wings beat rapidly, but the flight seems slow and laborious as with legs dangling and tail spread, the creature presents an ungainly appearance. During the ascent a continuous warble seems to indicate that the object which we see in the dim twilight is in a fit of ecstasy. Scarcely can we attribute this melodious outpour to such a droll-looking bird as the woodcock. The "songster" has reached a height of several hundred feet, and the liquid notes become more intense until the music suddenly ceases, and the bird darts obliquely to the ground, alighting within a few feet from where he arose. The "speak" is resumed and in about sixty seconds another flight is made.

The three outer primaries or quill feathers of the woodcock's wings are shorter than the others. These undeveloped primaries are turned edgewise during flight, producing a decided whistle, which is often the first intimation we have of a woodcock's presence.

Woodcocks are active during cloudy days, venturing forth to feed upon the earth worms then on or near the surface. In undisturbed localities they do not flush until one is within a few feet of them when they suddenly spring into the air, rising perpendicularly to a height of ten feet then flying rapidly away in a zigzag course, suddenly dropping back into cover.

Various tints in the plumage harmonize remarkably with the brush, grass and leaves when the woodcock is on her nest. A soft leafy hollow in the earth at the base of a shrub or under a fallen bush is used for nesting purposes. While the bird is laying she cleverly covers her eggs with leaves, commencing incubation when the fourth and last egg is laid.

Sitting woodcocks exhibit so much confidence in their protective coloration that I have frequently removed the parent from the nest with my hand. I have watched them for hours, and have yet to see a sitting bird show uneasiness until I am within two feet of the nest, unless her winking is too quick for human eye; she is able to suppress even that. The male is usually found near the incubating bird.

Often the country is covered by a snowfall in April, when the woodcock becomes wary and vacates the nest at the least indication of danger. This clearly illustrates that she realizes protective coloration has ceased while the earth is clothed in white.

The four eggs are creamy or light brown, spotted and blotched with various shades of brown and lilac. Incubation continues three weeks, and the young leave the nest as soon as hatched to be piloted about through the underbrush.

230. WILSON SNIPE. *Gallinago delicata*. 11.25 in.

This famous game bird, known also as jacksnipe, English snipe and common snipe, has an extensive range covering North America in general. Late in March Wilson snipe return to the Great Lakes region, resorting to cornfields, marshes and other places where black rich soil is in evidence. It feeds after the manner of the woodcock by probing with the sensitive bill into the earth for worms and tender rootlets.

A startled snipe springs from the ground with a "yeip-yeip-yeip," flying swiftly and irregularly, but usually dropping into cover within a few seconds. After alighting it runs swiftly over the ground for several yards and again

settles down to feed. This bird has been found breeding about Salt Lake, Utah, and occasionally in the states bordering Canada. The favorite breeding grounds are from the Atlantic to the Pacific through the southern half of Canada.

The nests are mere depressions in the soft soil near a marshy place. Four beautiful eggs are deposited with the small ends together on a little bed of dead leaves and grass. The eggs are greenish drab marked with spots and lines of rich brown and black. In April while searching for woodcock in the Great Lakes region the writer has frequently witnessed the song-flight of the Wilson snipe. The first intimation that such a performance is contemplated is a clucking which is uttered in the shelter of a few rushes or a little grass. Presently a snipe rises and circles about overhead. At intervals the bird darts obliquely through the air, producing a whistling sound resembling the whiz of a missile through space. Suddenly the bird drops to the ground and resumes his clucking. He soon takes to wing again, and this time maintains a horizontal course at a low elevation until joined by the female.

255. YELLOW-LEGS. *Totanus flavipes*. 10.7 in.

This is the bird commonly known to the sportsman as the lesser or summer yellow-legs or yellow-legged plover. In general habits and color there is little difference between this and the greater yellow-legs. The present species, however, is probably more partial to the interior during migrations. Yellow-legs winter from the Gulf to Patagonia. Their breeding range is chiefly, if not entirely north of the United States, but many summer in the Great Lakes region. These waders like others of their family do not always breed until they are two years of age, and so many are encountered during the spring and summer in latitudes quite southerly for this sub-arctic shore bird. Arriving in the Great Lakes region after the first warm rains of April, the yellow-leg tarries in wet meadows until the last of May. Two or three days of

almost continued flight carry these powerful fliers into the colder climates of Labrador and Hudson Bay.

The three or four eggs are deposited soon after the birds arrive at their breeding grounds. I have a set of eggs from Alberta, Canada. The background is light greenish drab, and the markings of rich brown and purple are clustered about the large end. These are large for the size of the bird, and the young emerge from the shell strong and able to run in twenty-four hours. The southward flight commences early in August, and the birds linger in temperate North America until cold weather lessens their food supply, when they resume their southward journey to the equator and beyond.

258. WESTERN WILLET. *Catoptrophorus semipalmatus onornatus*. 15 in.

The Willets are the largest of our short-billed shore birds, in fact, they are exceeded in size only by the curlew and godwits of the entire shore bird family.

The true willet is an eastern form occurring on the Atlantic seacoast, breeding usually on the islands opposite Georgia and the Carolinas.

The western willet is very similar, but slightly darker in plumage, occurring from western Indiana and southern Texas, up the Mississippi valley, through Illinois, Dakota, and Kansas into Canada.

These birds partake of the habits of the true plovers, sandpipers and especially the yellow-legs, like which they usually travel in small flocks, and are extremely noisy, especially during the breeding season. It is a common occurrence, however, to meet with a solitary bird feeding on the sandy beach of our large inland lakes, or on the edges of marshes. They often breed in small colonies.

Willetts are beautiful birds when on the wing. Their flight is strong, and the black and white effect is a conspicuous field mark. Their food consists of small insects and aquatic life, which they obtain from the surface of the ground in both wet and dry places.

The bird takes its name from the clear, flute like notes,

which are uttered in syllables sounding like Pill-Will-Willet, Pilly-Willy-Willet repeated in rapid succession.

The western willet is found nesting on the prairies of Minnesota, Dakota and Manitoba. Unless the parent bird has been sitting upon her eggs for some days, she vacates the nest at the slightest indication of danger and approaches the intruder from the opposite direction. The nests are, therefore, very difficult to find, unless the eggs are well incubated, when the mother sits close, vacating her nest when the intruder is almost upon her. The nests are often built in clumps of grass where the water is a few inches deep, or on a grassy slope or tableland overlooking the water.

On Mustang Island, in the Gulf of Mexico, the western willet breeds in colonies. Arriving on the island, the ornithologist is greeted from all sides by the male birds circling about overhead, calling so incessantly that the intruder hears nothing else until he leaves the island, and the birds settle down into the marsh grass to resume their nesting.

The four handsome, pear-shaped eggs vary greatly in color.

261. UPLAND PLOVER. *Bartramia longicauda*. 11.5 in.

This handsome wader with a dove-like disposition, though a true plover, is often called the Bartramian Sandpiper, Field Sandpiper, Prairie Pigeon, and Quail.

These birds breed from New Jersey, Illinois, and Colorado northward, wintering in South America. Though shy of footmen they show little fear of those on horseback. Protected by plumage resembling dry grass, they are difficult to detect.

Several years ago I was walking through a pasture, when one of these birds approached the roadside and with upraised wings alighted on a fence post and eyed me curiously. Her plaintive alarm note was a quavering whistle quite in keeping with the way she folded her long pointed wings. Two years later when in the same locality I was walking against the wind one warm day when a bobolink

fluttered to the grass six feet ahead. Parting the grass and weeds, I decided to secure this nest for a group and settled myself preparatory to making a few notes. After some fifteen minutes I placed one hand behind me to arise, when my finger-tips touched something soft, and a bartramian warbled from a tussock within an arm's length. She was a "crippled bird," and her notes indicated the utmost distress.

During the nesting season the male bartramian mounts high in the air, and on quivering wing utters a long drawn out plaintive whistle. This sound when first heard usually produces an uncanny effect upon the listener, who is unable to identify its author which appears outlined against the sky as a mere speck. Presently the bird volplanes to the earth and runs nimbly over the grass in a most unconcerned manner.

The four large pear-shaped eggs rest in a grass-lined cavity with their points together. The back-ground of the egg varies from creamy buff to a decided clay color. The eggs are marked with spots and blotches of dark brown and lilac.

263. SPOTTED SANDPIPER. *Actitis macularia*. 7.5 in.

The Spotted Sandpiper, Tip-up, or Peetweet, is probably the commonest and most familiar of our small wading birds. It is a typical representative of the large family of shore birds, and is found from Brazil northward to the Arctic regions about Hudson Bay and upper Alaska. They breed throughout their North American range, spending the winter about the Gulf coast and southward. Scarcely any of our artificial lakes or lagoons in our parks are without a pair of these restless little birds. They run swiftly over the pebbly beaches, calling in shrill whistles "peetweet" incessantly as they tilt the body forward and backward.

They habitually fly so close to the water as barely to keep the tips of their long wings from touching. So partial do they become to certain spots along the shores,

that if disturbed, they return to the spot from which they were originally disturbed as soon as the intruder has passed.

The eggs are laid during the second and third week of May. Grassy or weedy spots close to the water's edge are covers under which the female scratches a slight hollow, lining it sparingly with dry bits of grass and stems. Four pointed eggs are laid. They have a buffy or clay background, and are daintily and heavily marked with black and umber. The little spotted sandpiper is the same size as our cowbird, but deposits an egg three times as large. The young have so developed within twenty-four hours after hatching that they may be seen following their parent about the edge of our creeks and ponds.

264. LONG-BILLED CURLEW. *Numenius americanus*. 24 in.

This king of shore birds is the largest of his tribe and seems to reign supreme in the territory over which he ranges. The curlew has retreated since the settlement of the middle and western United States, as not many years ago it was of regular occurrence from the Atlantic to the Pacific, while it is now rare east of the Mississippi. Vast stretches of uncultivated lands of the west still afford the curlew suitable feeding and breeding grounds, so they still abound in the prairies of Nebraska, Colorado and Montana. During my trip up the Yellowstone River in 1906, I found this bird far out on the prairies in company with upland plover and the sage hen. During the heat of the day the birds appear in pairs about small alkali pools, where the remarkably long bill is perfectly adapted for removing crawfish from their holes.

I watched a pair through my fieldglasses as they were feeding about a pond. Presently they flew to the distant hills. Long had I wished to locate a curlew's nest. The female had undoubtedly returned to her eggs. Distance in the western country is deceptive, so I walked fully two miles before raising the suspicion of the male. He cir-

pled about, coming within three feet of my face and suddenly darting upward. I scanned every foot of ground, and found after two hours' search that the wary male had led me 500 yards away. I retraced my steps to the spot where he first attacked me. He became frantic in his efforts to again mislead me, but I continued straight ahead and presently he was running about the ground in front of me. I dropped my hat, to mark the spot even if the vegetation was too scant for concealment. Finally I saw the female lying perfectly flat with neck and bill on the ground. She was completely surrounded by prickly pears, and so, safe from prowling animals and reptiles. I advanced when she arose, shook herself and ran rapidly away. The male was calling so noisily that seven other curlews joined in the attack.

The four eggs rested in a little hollow with the points together. They were pear-shaped having a pea-green background beautifully spotted with different shades of maroon. These eggs are slightly larger than those of our domestic turkey, though laid by a bird only one-fourth as large. This gives a good idea of how large are the eggs of the shore bird in proportion to those of other species. They perform such extended migrations that these birds have no time for nest building, and the young attain such development and strength before hatching, that they are able to care for themselves in a few hours.

270. BLACK-BELLIED PLOVER. *Squatarola squatarola*. 11 in.

The Black-Bellied Plover, or Beetle Head, is nearly cosmopolitan; it breeds in the Arctic regions, and in America, winters from Florida to Brazil.

This bird in its various phases of plumage closely resembles the golden plover, but can be positively identified at any season of the year by the presence of a hind or fourth toe, which is wanting in all other plovers. These birds have the legs and wings remarkably developed. Plovers lack the long boring bills which are possessed by

the sandpipers and woodcocks. The bills of these common tide birds are short and stout, and they pick their food from the surface of the earth, feeding on both high and low land.

In spring and summer the breast is one mass of jet black feathers, the upper wing coverts, tail and back being light gray. The feathers are white with innumerable little bars of dark brown, giving the bird a beautiful gray effect, so in contrast to most birds which are darker above.

The autumn migration is apt to be along the seacoast when the birds fly with the wind. During the spring migrations the golden plover frequently inhabits the prairies and uplands, but the present species are usually met with along the edges of streams and lakes, as it seems partial to feeding in muddy places. Here their plumage serves as a great protection, their lightly mottled backs blending perfectly with the rippling water beyond as they feed on beaches.

In spring these birds pass northward leisurely, often remaining in the United States until the first of May; in migrating they fly in lines or in ranks like geese. Their summer homes are in the Arctic regions, being most common upon the mossy barrens about Hudson Bay and Alaska. As the birds run swiftly over this gray vegetation they are hardly noticeable to the untrained eye, so remarkably do their backs blend with the sparse vegetation.

The four eggs are laid in a little hollow usually on an elevated spot in wet territory. The eggs are large for the size of the bird, but the young come into the world so heavily clad with down that within two weeks are able to shift for themselves.

272. GOLDEN PLOVER. 10.5 in.

The Golden Plover in its immature phase resembles the black-bellied plover, but is without the fourth or hind toe. During its migrations this popular game bird fre-

quents the upland prairies, and is much commoner than the black-bellied.

273. KILLDEER. *Oxyechus vociferus*. 10.5 in.

By far the commonest of American plovers, it breeds throughout the entire United States and most of Canada, and winters from the Gulf States to northern South America. A suspicious, restless, noisy, uneasy bird, always on the alert, it runs and flies rapidly. It inhabits the shores, beaches and margins of both fresh and salt water.

The food consists of mollusks, insects and their larvæ, largely gathered from the surface of the earth in both damp and dry places.

Plovers are quite cosmopolitan in their range and this species has been recorded on either hemisphere. Thousands of miles are covered annually in passing from its northern breeding range to the southern parts of South America. Mariners have reported small groups of plovers, sandpipers, and phalaropes resting upon the ocean hundreds of miles from land.

Cornfields and waste land are the areas occupied by the killdeer while breeding. Two broods are frequently reared in a season; the first setting hatches early in May, and four more eggs are laid late in July.

I have four eggs taken June 21, 1903, from a cornfield within the city limits of Chicago. The eggs are usually deposited in a slight cavity lined with pebbles, which harmonize remarkably with the dull blotched egg.

(So closely does it resemble the semi-palmated plover, that the one plate on the study answers for both.)

274. SEMI-PALMATED PLOVER. 6.7 in.

The Semi-Palmated Plover, a common migrant in the United States, closely resembles the killdeer, but is only half as large. The killdeer possesses two bands across the breast and the semi-palmated plover has but one. The latter breeds along the bleak coast of Labrador.

277. PIPING PLOVER. *Ægialitis meloda*. 7 in.

These retiring birds are very local in their range, but occur at irregular intervals along the beaches and on the islands in the Great Lakes region, west to several other large inland bodies. Devil's Lake, North Dakota, and Lake Manitoba, Canada, are frequented by this retiring shore bird. Along the Atlantic coast from Long Island to the Gulf of St. Lawrence, the birds breed among the debris not far above high watermark. They winter from Florida southward.

The dark band across the breast is more distinct in some species; hence, for a time, scientists divided the birds, calling the eastern forms the piping plover, and the birds taken west of Lake Erie were described as the belted piping plover. Further investigation developed the fact that the range had practically nothing to do with the distinctiveness of the band on the breast, and the birds are all now recognized as the piping plover.

May 30, 1911, we plodded through the sand among the scant evergreen and sand dunes overlooking the south shore of Lake Michigan, a desolate country, too clean and barren of plant and animal life to satisfy many birds. Small colonies of bank swallows were perforating the little perpendicular bluffs, and about the old pine stubs the white bellied swallows hovered, while occasionally a herring gull patrolled the beach, as a scavenger. A metallic peep came from the base of a sand dune, and with fieldglasses I carefully scanned the vast waste. A piping plover flitted across the beach, circling over the pebbles and driftwood, and squatted in the center of a little elevation just back of a sheltering log. As I approached the sitting bird, she rapidly ran in a wide circle, joining her mate. Both were solicitous and approached me in a distressed attitude, plaintively protesting at my intrusion, by calling in their mellow notes which were so in keeping with the bleak surroundings.

The eggs rested in a bare hollow of the white sand, with their four points together, dainty little clay colored shells, minutely dotted with purple and dark brown.

8. GROUSE.

Of the two hundred species of the grouse family, sixty only are found in the new world. With few exceptions these birds are not migratory. After nesting they gather in covies or bevvies—birds of one family, which in some species unite and form large flocks. They are usually resident throughout the year where found.

While usually terrestrial, some use the trees when flushed. Obtaining their food from the ground, they are scratchers with strong legs and feet and well developed nails. The plumage is of dull colors to harmonize with the grass surroundings. These game birds seek safety by hiding rather than by their rapid flight, which starts with a whirr as they beat the air with their short stiff wings. Protective coloration is marked.

Of the pigeons and doves, twelve species only are found in North America. Some of these are arboreal, others are terrestrial; some are found in forests, others in prairies; some nest in colonies, others in pairs, but they usually flock after the breeding season. When drinking they do not raise the head as do other birds, but keep the bill immersed until they have finished drinking. The young are born naked, and fed by regurgitation. They are less prolific than other game birds, and yet the wild pigeons were formerly our most numerous bird. The mourning dove is the most common representative in eastern North America.

Vultures belong to the raptors or birds of prey. For convenience we have placed the Turkey Vulture among the grouse, partly in order to show the relationship between the vulture and our turkey. Scientists regard the turkey as developed from the vulture through terrestrial habits. Vultures live on carrion, and have naked heads and feet the better to enable them to act as scavengers. Except in nesting season they are usually found in flocks, returning to the same roosting place regularly. Strong fliers, they often sail majestically for minutes without an apparent wing stroke.

They have no note except in case of alarm. In America the range is less northerly than formerly, because dead animals are now disposed of or buried, where they formerly remained on the surface to decay. In the South they are protected by law and public sentiment. The sense of smell is keen but sense of sight is especially so.

QUESTIONS.

When quail or other regular grouse are flushed what of noise of wings? Tell how they fly, as to wing stroke, etc.? Why are feet, especially nails, so well developed? What of color protection of bob-white? Of ruffed grouse? Of ptarmigan? Of prairie sharp-tailed grouse? Of prairie hen? In which is protective coloration shown more strongly, in terrestrial or in arboreal forms? Why is protection not so important for the arboreal forms like doves? Which lay more eggs, the terrestrial or arboreal birds of this group? Why should the bob-white be so prolific? What should farmers do to protect this bird? Which bird has snow shoes in winter? What of relationship of turkey and vulture? Why is vulture protected in the South?

289. BOB-WHITE. *Colinus virginianus virginianus*. 10 in.

The Bob-White, often called quail or partridge, is a resident of eastern and middle North America. The male is handsomely mottled with a shade of soft reddish brown almost approaching old rose; black and white is conspicuous in various places. In the female, colors are more sombre, the white being replaced with buff. The bob-white like most ground birds is well protected by color resemblance to the surroundings. The original name quail applies to an Oriental bird mentioned in the Bible.

The clear distinct call notes of the male give rise to the name "bob-white." The three-syllabled whistle sounds like "Me-bob-white," with particular emphasis on the last syllable. The first syllable is rather faint, and at a distance one hears nothing but the name "bob-white."

As a call note during the fall and winter when the birds are flocking, the syllable "me" is used by the different birds in reorganizing the little band which has become scattered.

The bob-white is resident in the same locality, and for mutual protection, remain in small flocks of from ten to thirty from September until early April.

Their method of "roosting" is practical and picturesque. During the short days of winter when the snow is in the woods, I have frequently tracked the little fellows to the edge of a brush pile, where the flock is encamped for the night. They cluster in a circle, the tails together, each bird facing in a different direction. This formation conserves the heat of the body, and gives the best protection from their natural enemies, as there is a guard on the lookout at every point of the compass.

The food of the quails is both insectivorous and vegetable. They destroy great numbers of insects, including chinch bugs, beetles, grasshopper, the seeds of detrimental weeds and grasses, with some berries and grains. The destructive hessian fly is the natural food for the young, as the mother leads them into a wheatfield if possible. Bob-whites should be fed in bad weather in the winter, especially at time of deep snows or sleet, and should be protected by law throughout the year.

A disturbed flock of bob-white spring from the ground with startling wing-beats, each bird pursuing a different course, alternately flapping their wings and sailing and dropping into cover within a few seconds. They run rapidly after alighting, and soon squat close to the ground in an attempt to escape detection. Assembling call notes then bring the flock together. These birds are not polygamous, like many of our game birds, but remain in pairs through the breeding season.

The nests are placed in fields, orchards and pastures. A thick clump or tussock of grass with an opening at the side is used by the birds as a nesting site. A little hollow is scratched in the earth, and dry grass is about the only thing that is used in constructing the nest. From eight

to twenty pure white eggs are laid. Unlike the eggs of any other partridge or grouse, they are pure white when laid, though dampness frequently stains the shells before the young are hatched.

The birds thrive in cultivated sections and are practically domesticated, but frequently desert a nest of eggs when the sitting bird has been flushed or nest disturbed. Both male and female assist in the duties of incubation, which trait is uncommon among gallinaceous birds. Two broods are frequently reared in a season; the first setting is begun in April, and another nest of eggs may often be found late in June, or as far into the summer as early August. The young run about as soon as hatched.

The Florida bob-white is a sub-species confined to the southeastern part of the United States. It is somewhat darker in plumage. Another variation in plumage, known as the Texas bob-white, may be found inhabiting Texas and New Mexico. These birds are slightly smaller in size, and the peculiar old rosetint found in the plumage of our common bob-white is replaced by gray in this species.

296. MEARN'S QUAIL. *Cyrtonyio montezumæ mearnsi*.

This remarkably handsome quail was first reported in the United States by Dr. Mearns, hence now generally known as Mearns' Quail. The birds originally confined themselves to the mountainous regions of Mexico, but have crossed the Rio Grande, and inhabit the arid regions of western Texas, New Mexico and Arizona. They are probably the handsomest of our native gallinaceous birds, the males possessing eleven decided shades in plumage during the nuptial season. These stupid creatures often permit themselves to be taken with the hand before moving, hence the name "old hen."

300. RUFFED GROUSE. *Bonasa umbellus umbellus*.
17 in.

Among New England sportsmen, the Ruffed Grouse, often called Partridge, is the favorite game bird. The true ruffed grouse occurs in New York westward through

the United States to the Rocky Mountains, becoming rather scarce beyond the states bordering the Mississippi. Maine and the White and Green Mountain regions northward into Quebec is the home of the Canada ruffed grouse, a sub-species slightly larger. Two other forms occur in the West; the Oregon ruffed grouse inhabits the Pacific coast, and the gray ruffed grouse is found in the northwest, east of the Sierras and within the Rocky Mountain region.

One of the most marvelous examples of adaptability to climatic conditions is shown in the feet of the ruffed grouse. The birds are resident the year around wherever found, and, requiring snow shoes for winter, the toes in fall are equipped with fine stiff projecting feathers, extending horizontally on either side of the toes, resembling a double-toothed comb in form. This added foot surface enables the bird to walk with ease on the surface of the snow. The projections drop off at the approach of warm weather.

Birds give vent to their emotion during the mating and breeding season by various vocal sounds, many of which are highly musical. Some species produce what is known as wind music, such as the boom of the nighthawks, caused by the birds swooping earthward from a height, allowing the air to pass through the primaries turned on edge. Of a somewhat similar nature is the "drumming of the grouse"; the bird assumes an attitude similar to a strutting turkey gobbler, as from stump or log with spreading tail he rapidly beats the sides of his body with the wings, producing a sound like the muffled roll of a drum.

The flight of the partridge is terrific but of short duration. When flushed by the gunner he seems to have the faculty of keeping the trunk of a tree between himself and the enemy. If the birds are disturbed by a prowling animal or untrained dog, they take readily to the lower branches of trees, and will permit a person to walk directly under them without attempting to fly. They are often killed from such perch by unsportsmanlike hunters.

Grouse choose a varied diet; insects, spiders, wild berries and small fruits, also partaking of grains and fresh sprouted vegetable matter.

The nests are usually a hollow in the leaves at the base of a tree or under a fallen branch. From eight to ten cream colored eggs are laid. The bird sits extremely close, and one may pass within a few feet of the parent bird without disturbing her. The nests are usually near an opening in the woods, or on a small incline overlooking a damp or swampy place. The young are piloted about by the mother as soon as they leave the shell. Protective coloration is marked.

304. WHITE-TAILED PTARMIGAN. *Lagopus leucurus leucurus*. 14 in.

Ptarmigan inhabit the colder regions of America and Europe. Their occurrence is in western Canada and in the United States, chiefly in the mountainous regions of Colorado, Montana, Idaho, Oregon and Washington, where they reach an altitude possessing a decidedly boreal climate. During the winters they sometimes descend into the plains and feed upon wild sprouts, and berries. The winter plumage is pure white, while in spring the feathers are brown mottled with gray. Both types of coloration serve to protect the birds from their natural enemies. They range in comparatively open places, and in winter their immaculate feathers enable the birds to move about over the snow without attracting the attention of their natural enemies, eagles, owls, foxes and other carnivorous creatures. Their summer homes in the mountain ranges are often above the timber line, where nothing but a sparse growth of moss exists. The birds at this season of the year are very difficult to find, owing to the similarity of their plumage to the surrounding rocks and vegetation.

Ptarmigan are seldom hunted with dog or gun and consequently are approachable, often exhibiting no more fear of a man than does the ordinary barnyard fowl. The white-tailed ptarmigan inhabits the Rocky Mountain and Sierra Nevada ranges from Colorado northward to Alberta and British Columbia.

Naturalists have not found it possible to make many extensive observations of this interesting bird during the

breeding season in June, because it nests in a region subject to violent weather changes during the early summer, making a camping outfit imperative to provide against violent storms.

305. PRAIRIE CHICKEN. *Tympanuchus americanus americanus*. 18 in.

The Prairie Chicken, or Prairie Hen, was formerly one of the most common birds on the plains and prairies of the middle and western United States and Canada. In Minnesota and Manitoba this famous bird is found in the same districts as its lighter plumaged relative, the sharp-tailed grouse. Certain portions of Oklahoma, Kansas and Texas are the haunts of the rare and smaller form, known as the lesser prairie chicken.

The prairie chicken, or pinnated grouse, like the turkeys, are polygamous. In August the young and old congregate in droves, numbering from a dozen to upwards of a hundred. Over the grain and stubble fields and into plowed ground these flocks forage from early fall until the first spring thaws. In March and early April they begin to disband, and the males may then be heard "booming" at sunrise from some elevated spot exposed on all sides. The cocks have a small patch of loose skin on either side of the neck, which they are capable of inflating with air until these bare spots swell to the size of a large crabapple, resembling little oranges. While the males are filling and emptying these pouches, the head is lowered and the wings partially spread and drooping. Several cocks assume this posture simultaneously, each facing the others and booming alternately. At this juncture it is not an unfamiliar sight to see a hen fly directly in their midst, when a battle royal ensues. Perhaps the madam has just left a setting of nine to eighteen eggs, but she soon leaves the rivals to their comical antics.

The nest is usually prepared in a sheltered spot, under a clump of dead weeds or a bunch of weather-beaten grass, or at the base of a small bush or shrub. The parent scratches a slight hollow in the earth, lining it with dead

vegetation and a few feathers from her own breast. The first egg is laid sometimes as early as April 20th, but usually during the forepart of May. The period of incubation is three weeks, and the young follow the mother as soon as hatched.

The prairie chicken has many natural enemies. Snakes, weasels, minks, coyotes, rats and crows are among the many which tend to decrease the broods by destroying the eggs and devouring the chicks. What could be a more tempting morsel for the horned owl or a prairie falcon? Wet, cold springs retard the nesting and result frequently in flooding the nests. The prairie chicken usually deserts a disturbed nest, and now too few good nesting sites remain. Fortunately many states have protected these birds for some years by not allowing any shooting. As a result in many sections this magnificent bird, so beneficial to the farmer, is occurring in something like its former abundance. They are hardy birds, residing the year round in the same locality unless driven to other sections by persecution.

Their food is principally grain, berries, grasshoppers, beetles and willow buds. Their value to the farmer is almost as important as that of the bob-white and meadow lark, all of which thrive in cultivated sections, where the agriculturist must realize that the day is not far distant when he must choose between the grasshopper and other pests and these resident game birds, which thrive if they are afforded protection from the gunner.

308. PRAIRIE SHARP-TAILED GROUSE. *Pediacetes phasianellus phasianellus*. 17.5 in.

The Sharp-tailed Grouse in this form is found chiefly in the Dakotas, Minnesota and western Wisconsin. Occasionally they have been recorded in northern Illinois. It is partially migratory, living in prairies in summer and wooded regions in winter.

The true form of the sharp-tailed grouse is a more northerly species, inhabiting the west and central portions of Manitoba and Alberta. In the northwestern section

of the United States from Montana to the Pacific including Washington and Oregon, the Columbian sharp-tailed grouse, another species, occurs. The sharp-tailed grouse may be met with in the same sections occupied by our common prairie chicken, but may be readily distinguished from it by the feathered legs and toes. The Columbian sharp-tailed is fond of wild fruit, so that during the fall they move from the prairie lands into the cranberry marshes to feed.

Prairie sharp-tailed grouse are considerably lighter in color than the prairie chicken, and the underparts are without the barred effect. In winter they hide in the deep snow and tunnel beneath the crust to feed on the sprouts of willows, larches and aspens. Like the ruffed grouse it frequently roosts in trees, but during the spring and summer months it remains on the ground.

From seven to twelve eggs are laid late in May or early in June. Some sets bear a close resemblance to those of the prairie chicken and are dark olive green. Others are grayish drab sparingly covered with markings of pale brown. I found this bird breeding in the rolling prairies of western Minnesota during the first half of June.

310b. WILD TURKEY. *Meleagris gallopavo silvestris*.
48 to 50 in.

This great game bird is nearing extinction in many sections of the United States. Fifty years ago it was of common occurrence from the Atlantic to Kansas and Missouri, while today few states can claim this noble bird as a resident. A sub-species, the Florida wild turkey, haunts the almost inaccessible portions of Florida, where shrubbery and wild fruits prevail. In the southwest, other varieties still range in the mountainous regions of Missouri, Arkansas, Oklahoma, Texas, New Mexico and Arizona.

In the Aransas Pass region of southwestern Texas, I encountered several small flocks of the Mexican wild turkey in February and March, when the gobblers were noisy and aggressive. The Mexicans sometimes use dogs in hunting this gallinaceous fowl; when pursued down hill

it does not seem to occur to these birds that escape is possible by flight only and as a result they are caught. I have never known a dog to capture one when the turkey was running up a hill, though turkeys seldom take refuge from a dog by flight.

Large pecan trees in the mountains along little streams are favorite roosting places for these wild turkeys which frequent the same tree nightly. Before sunrise the males of these polygamous birds may be seen strutting through the fields with drooping wings, gobbling incessantly and challenging every other gobbler. I was fortunate in discovering a nest under a fallen tree on a little knoll between two gullies. The bird used a large quantity of dead leaves and feathers in constructing the nest, so that it was suggestive of a wild duck's nest. It contained thirteen eggs when found. In shape and markings they resemble those of the domestic turkey, but are slightly paler and smaller.

315. PASSENGER PIGEON. *Ectopistes migratorius*.
16.2 in.

The former range of the Passenger Pigeon, or Wild Pigeon, was eastern North America, northward to Hudson Bay.

"No more marvellous tales have been handed down to us from a remote past than those which our own fathers tell concerning the former abundance of the wild pigeon, during its migrations and in its breeding haunts. During their passage the sun was darkened, the beating of their wings was like thunder, and their steady oncoming like the continuous roar of Niagara. Where they roosted great branches, and even trees two feet in diameter, were broken down beneath their weight, and where they bred a hundred square miles of timber were weighted down with their nests. When they lighted on the ground in vast swarms to feed, the rear birds flew over the flock to alight in front, looking like a rolling surf wave of blue.

"Until the middle of the last century the species enjoyed a general distribution throughout eastern North America,

and was found scatteringly to the Pacific coast. The birds were, however, rather irregular in their habits, and the center of abundance within historic times was in the north central states. They were best known from Kentucky, through the accounts of Wilson and Audubon, and in Michigan, where the birds had their last known stronghold, and where the last considerable flight was observed in 1888. In Kentucky, they bred and occasionally wintered in such numbers that Wilson once computed a single flight at upwards of two billions. Since the pigeons appeared absolutely countless, their destruction was carried forward upon a colossal scale. Men gathered them with nets and knocked them down with poles, or felled trees to secure the fat squabs. At Pentwater, Michigan, people lined the cliffs and beat them down with sticks as they passed the crest of a ridge, until the ground was heaped with countless thousands. Powder and shot were deemed unnecessary, although fifty-nine pigeons are reported as killed by one discharge of a shotgun.

"In 1878 Prof. H. B. Roney wrote in the *Chicago Field*, (Vol. X, pp. 345-347):

"The nesting area situated near Petoskey included not less than 150,000 acres within its limits. The number of the dead birds sent by rail was estimated at 12,500 daily, or 1,500,000 for the summer, besides 80,352 live birds; and an equal number was sent by water. We have,' says the writer, 'adding the thousands of dead and wounded ones not secured, and the myriads of squabs left dead in the nest, at the lowest possible estimate, a grand total of 1,000,000,000 pigeons sacrificed to mammon during the nesting of 1878.'

"It is evident that such wholesale slaughter could not go on forever. The extraordinary flights suddenly ceased during the '80s. Since that time, "What has become of the passenger pigeon?" has been the puzzling question. It is known that the birds still breed by single pairs, to some extent at least, but doubtless the passenger pigeons are gone—gone irretrievably after the manner of the bison—lost in the maw of human greed.

"One or two white eggs in a rude platform of sticks was laid on every available branch." (Adapted from Dawson's "Birds of Ohio.")

316. MOURNING DOVE. *Zenaidura macroura carolinensis*. 11.8 in.

The Mourning Dove ranges throughout the United States and southern Canada, breeding from Cuba north to Ontario and Quebec.

Since the extinction of the passenger pigeon, the mourning or turtle dove is the only representative of the family we have in eastern North America north of Florida and Louisiana. The bird's rapid and irregular flight is accompanied by a whistling of the wings. Disturbed while nesting the birds alternately flutter and hop until they have misled the trespasser. Mourning doves are gregarious when migrating, and again flock soon after the young leave the nest. When gregarious they visit cornfields, consequently their flesh is very palatable, and farmers kill them in great numbers in open season as game and because of their destruction of grain. Fond of salt, they are found where stock is salted.

The love song has a pathetic tone which gives the name "mourning." Orchards, groves and roadsides grown up with shrubbery are favorite nesting sites. The young are fed after the manner of the albatross, petrels and humming-birds, as the predigested matter is introduced into the crop of the young by regurgitation.

Two white eggs are deposited in a loosely constructed nest of sticks, near the ground in the East, sometimes on the ground in the West.

325. TURKEY VULTURE. *Cathartes aura septentrionalis*. 30 in.

The Turkey Vulture ranges throughout temperate North America, as far north as southern Minnesota and New York, wintering in the southern states.

Vultures, like our gulls, are scavengers, but the former subsist chiefly on carrion and rarely attack living creatures.

The nostrils are highly developed, and the sense of smell is extremely keen, while the sense of sight is even more highly developed.

Vultures have the head and neck bare of feathers, and they are really repulsive looking at near sight, though distant flight is graceful. Our American vultures are capable of prolonged flight without any apparent movement of the wings. This seems like a violation of the laws of gravity, but in their majestic soaring, I have watched them ascending or descending, while moving in great circles without once flapping the wings. The birds are much more numerous in the South from Florida and South Carolina west to New Mexico.

They are protected in all the Southern states, and it is not an unusual sight to see small groups of both turkey and black vultures feeding in the public streets, where they exhibit no more fear than our domesticated pigeons. Dr. Geo. F. Gaumer, of Central America, informs us that the killing in immense numbers of certain herons, gulls and other scavengers has resulted in an increase of human mortality among the inhabitants of the coast. This tends to show how certain birds assist in keeping the beaches and public highways free from decaying animal matter.

Many farmers claim that hog cholera and other animal diseases are carried by these scavengers, so they are inclined to kill them. In the North dead animals are now generally burned or buried, so that these birds do not now range so far north as formerly.

The turkey vulture is not an uncommon summer resident in Ohio, Indiana and Illinois. It is found along the Illinois River in the vicinity of Starved Rock. According to the latitude, one or usually two eggs are laid from March to June. Small cavities or crevices in the rocks, hollow logs and hollows in trees are used as nesting sites. Practically no nest is constructed. The eggs, deposited on the bare rocks or leaves, are white or greenish white, blotched and splashed with shades of purple and red.

The turkey vulture was placed here, in part, because the hawk chart is crowded, and in part, to show the relation of the turkey to the vulture.

9. HAWKS.

Falcons, Hawks and Eagles are distributed throughout the world, and about thirty species are found in North America. During the migrating season they often travel in flocks; at other times, with few exceptions, they are solitary or found in pairs, the female being slightly the larger. At all times these strong fliers are on the alert for food, which consists largely of small animals, insects and birds. They have telescopic eyes and a remarkable vision. The members of this family have strong talons, for capturing and holding prey, and strong hooked beaks for tearing flesh; they possess a stomach instead of a crop. They do not swallow feathers and bones, as do owls.

QUESTIONS.

As a class why are hawks useful? Since some hawks are highly beneficial to the farmer and others destroy birds and poultry, what of importance of identifying the various species? Compare mode of catching fish of osprey, kingfisher, heron, merganser, pelican, bald eagle. What is the smallest hawk of this vicinity? The largest? Account for the names of as many of these birds as you can; as sparrow-hawk, marsh hawk, etc. What is the most noted bird of history? Give story of "Old Abe." Is the bald eagle really bald? Why then called bald? Why should hawks and eagles see so well? Why is eye called telescopic?

327. SWALLOW-TAILED KITE. *Elanoides fortificatus*.
24 in.

The wing development of the Swallow-tailed Kite and the everglade kite is remarkable. Like the frigate bird and swifts, the wings extend far beyond the tail. The Mississippi and white-tailed kites, two other American forms, have less wing development, and their flight is more suggestive of the ordinary falcon. In Europe the name kite is applied to birds which resemble our common hawks. The swallow-tailed kite was formerly found as far west as the great plains, and northward to southern Canada. They winter in Central and South America. Always of

local distribution, their range is becoming even more restricted.

The food of this hawk consists largely of insects, hence it is beneficial, it also eats small reptiles. It captures its food, devours it and drinks while on the wing. Kites migrate in flocks. In the last twenty years several migrating flocks have passed through the Great Lakes region near Chicago in spring and fall. This would indicate that the birds were either on an extensive hunting expedition, or resorted to some remote section of the country to breed. However, little material is available regarding their habits, aside from that furnished by Florida and Texas ornithologists.

During the last fifteen years these birds have been found breeding in Texas and the isolated pine regions of Florida, being about the only sections still inhabited with any certainty by this fleet-winged raptor. In Florida the nests are placed in the tops of the tallest cylindrical pines, usually in wet portions of the state where the nests are accessible only during dry seasons. In several scientific expeditions undertaken to procure the nest and eggs of this species, it was found necessary to kill the male kite before ascending the tree to the nest, as the bird boldly darted at the head of the collector, dislodging his head piece, and striking him with its talons until several deep wounds were inflicted.

The nests are constructed of stems, sticks and a little bark. Two or three eggs are deposited in April or May.

331. MARSH HAWK. *Circus hudsonius*. 19 in.

The Marsh Hawk, or Marsh Harrier, as this species is frequently called, ranges throughout North America and south to Panama, frequenting open stretches. In none of our hawks or falcons do the sexes exhibit a greater difference in plumage than in this species. The female is slightly larger than her mate, and her feathers are dark brown margined with several lighter shades. The male is light pearly gray, with bright yellow feet and legs. The unerring field mark is a white patch on rump. The legs

are exceptionally long and the wings are broad, enabling the birds to fly up and down our water-courses in a manner more in keeping with that of a tern or gull.

The food consists largely of mice, small reptiles and large insects. The birds are comparatively harmless to both the farmer and poultryman, and they are among our most valuable birds of prey.

During the mating season in May, the males perform evolutions in the air, turning somersaults, accompanied with screeching.

In both dry and wet places, dead rushes, grass and a few sticks are arranged in a circular nest, and the parent deposits four to six bluish white eggs, which are sometimes faintly marked with light brown.

The males become pugnacious, when the intruder approaches the nesting site, in order to monopolize his attention, while the female quietly leaves the nest from the opposite direction. A small clump of willows or second growth overlooking a stream are favorite nesting sites.

"Of 124 stomachs examined 7 contained poultry or game birds; 34, other birds; 57, mice; 22, other mammals; 14, insects." (Fisher.)

332. SHARP-SHINNED HAWK. *Accipiter velox*. 11.2 in.

The Sharp-shinned Hawk is the most daring of our small raptors. We should all have just cause to fear the eagles, if they displayed as much savagery in proportion to their size as does this little falcon.

The birds range from the Atlantic coast westward to the plains, but are more common in the heavily timbered sections of the northern states and the southern portions of Ontario, Quebec, Nova Scotia and New Brunswick. They are partial to groves of coniferous trees, hemlocks bordering a little stream or tamarack swamps.

When Mr. Richards, the eminent Connecticut ornithologist, attempted to take a nest, the sharp-shin attacked him with such vigor as to drive him to the ground for his dislodged hat. Sharp-shinned hawks have been known to

dash against window-panes in an effort to capture canaries. One exciting chase took place between a sharp-shin and a domestic pigeon which sought the shelter of a barn. The pursued reached the barn in safety and flew directly through a crevice under the eaves. The pigeon knew its goal, but the sharp-shin struck the side of the barn with fatal force.

Many of our song birds and domestic fowl are killed by this hawk. They are harmful to all birds, and every gunner is justified in shooting this or any other accipiter on sight. The female, as usual with hawks, is slightly larger than the male. When breeding the birds are so retiring that one rarely suspects their presence unless he examines the woodland closely.

Mr. Richards tells me that these birds still exist in some numbers about Norwich. Many of the nests he has found forty to sixty feet above the ground in the highest coniferous trees, bordering rocky gullies or trout brooks. About a fifth of the nests found were placed in deciduous trees, usually in a large crotch; sometimes an old crow's nest is fitted up and used. Sticks, roots and bark enter into the composition of the nests, which are large in diameter but comparatively shallow. Three to five extremely handsome eggs are laid.

"Of 159 stomachs examined, 6 contained poultry or game birds; 99, other birds; 6, mice; 5, insects, and 52 were empty." (Fisher.)

333. COOPER'S HAWK. 15.5 in.

Cooper's Hawk has many traits common to the sharp-shinned hawk. The habit of these savage birds of killing poultry and small birds justifies the farmer or poultryman in executing it. They are larger than the sharp-shinned hawk, and very common in the central and northern United States and southern Canada.

"Of 133 stomachs examined, 34 contained poultry or game birds; 52, other birds; 11, mammals; 2, insects; 39 were empty." (Fisher.)

334. GOSHAWK. *Astur atricapillus atricapillus*. 22 in.

The Goshawk and the Western Goshawk are inhabitants of the cooler portions of America. The former is found from the Atlantic west to the plains. The general size of this handsome raptor is about that of our red-shouldered or red-tailed hawk, but in disposition it is as savage as the sharp-shinned hawk. During severe weather goshawks visit the United States, sometimes reaching the Gulf States. The majority of them breed north of the United States, although they are occasionally met with in the Alleghany Mountains and in the northern portions of Michigan. Goshawks are frequently reported from the New England states in small flocks, ranging from six to a dozen in number.

Mr. Chas. Richards, of Connecticut, tells me these birds are great enemies of the ruffed grouse. He recalls the experience of his hunting companion who flushed a grouse, and before the sportsman could shoot a goshawk struck the grouse in midair, descending with it to the ground one hundred yards ahead of the hunter. Before the sportsman could kill the hawk, it had torn the flesh from half the breast.

Goshawks frequently visit the barnyards to raid the dovecotes and poultry yards. On a New England farm a goshawk attacked a flock of chickens, which rushed through the rear door of the farmhouse into the kitchen, followed by the hawk. It attacked one of the hens, when the farmer felled the bird with his walking stick. This bird like the accipiters should be shot at sight.

The goshawk nests usually in coniferous trees, placing their nests of sticks, twigs and weeds, lined with bark and moss, well towards the top of a hemlock or pine. Two or three pale bluish white eggs are laid.

"Of 28 stomachs examined, 9 contained poultry or game birds; 2, other birds; 10, mammals; 3, insects, and 8 were empty." (Fisher.)

337. RED-TAILED HAWK. *Buteo borealis borealis*.
20 in.

The Red-tailed Hawk inhabits the entire North American continent, but ornithologists have divided the species into several forms. The Pacific Coast representative is called the western red-tailed, while the bird inhabiting the Great Plains, northward into Canada, is known as krider's hawk.

In eastern North America the red-tailed is one of our best known raptors. In many sections of the middle United States it is resident the year around, not being averse to cold weather, if food is plentiful.

The broad square tail, with upper tail coverts a bright rufous, may be seen when the birds are soaring far above the treetops. Like the broad-winged hawk, the red-tail's call note is a whistle, though the birds are not noisy like the red-shouldered hawk. He is the largest of the common hawks and one of the most beneficial, deserving full protection, as he preys upon rats, squirrels and other small rodents and reptiles. Occasionally one may take a bird, but the benefit to the agriculturist far exceeds any havoc which these birds cause to poultry or other birds. The name "hen hawk" or chicken hawk frequently applied to this bird is entirely unjust.

The nests are built late in March or early in April. The largest trees in the upland timber appeal to the birds as suitable nesting sites. An immense nest of twigs, sod and hay, with a lining of smaller twigs, is constructed usually in a crotch near the main trunk or on one of the largest limbs of the tree. Some nests are as inaccessible as those of the eagle.

Two to four eggs are laid, usually three. The background is white or pale greenish white, and the markings appear in the form of spots and blotches of brown and lilac. The young do not leave the nest until they are between two and three months of age.

"Of 552 stomachs examined 54 contained poultry or game birds; 51, other birds; 278, mice; 131, other mammals; 47, insects." (Fisher.)

339. RED-SHOULDERED HAWK. *Buteo lineatus*
lineatus. 18.3 in. (male.)

The Red-shouldered Hawk, often miscalled Chicken Hawk or Hen Hawk, is probably the commonest raptor in the eastern United States. The note is different from that of our other hawks, being the one the blue jay enjoys mimicking so well, thereby having a little fun at the expense of the other birds. It is larger than any other common hawk except the red-tail. The red-shouldered hawk is partly migratory, arriving in the Middle States and Great Lakes region late in March. Its range is eastern North America, north to Nova Scotia and Manitoba; resident almost throughout the range.

The principal food consists of small rodents, snakes, sometimes a bird, but seldom a chicken, so it is decidedly a benefit to the farmer, because of their destruction to mice and ground squirrels.

The birds are partial to a given locality, returning year after year to the same piece of woods, and laying a second or third set of eggs if robbed of the previous set. Like most hawks the plumage of the two sexes does not differ, but the female is slightly larger than the male.

The nest, a bulky affair, usually placed in the crotch of a large tree along river bottoms or isolated groves, is constructed of twigs, sticks, and chunks of sod, lined with bark and leaves. The two to five eggs, usually three or four, exhibit great variation in color and style of marking.

"Of the 220 stomachs examined, 3 contained poultry; 12, other birds; 102, mice; 40, other mammals; 20, reptiles; 39, batrachians; 92, insects; 16, spiders." (Fisher.)

343. BROAD-WINGED HAWK. *Buteo platypterus*.
15.9 in.

This well-behaved raptor occurs in heavy timbered sections north of the Ohio River, from the Atlantic to the tier of states west of the Mississippi, north through Minnesota, Wisconsin and the Great Lakes region. The retiring habits make these birds less conspicuous than many of our large hawks. Their unsuspicious nature allows them

to be approached and killed by ignorant hunters who do not know their usefulness.

The adult birds are handsomely marked on the underparts with various shades of fawn and brown. The feathers are edged with white. Immature birds do not have the underparts barred, but the breast and sides are streaked with dark chestnut. Their note is a long drawn out whistle, often heard when the bird is concealed among the treetops.

A rather slow flying hawk feeding largely on insects, rodents, reptiles and rarely on birds, they are decidedly useful, and deserve full protection.

When disturbed on their nests, they fly to a distant tree and show very little alarm or anger. The nests are usually situated close to the tree trunks, twenty-five to fifty feet above the ground, preferably in trees situated in deep woods where the foliage is dense. The nests are of sticks and bark lined with green leaves, a peculiarity of this hawk. Two and three eggs are laid in May, about thirty days later than other hawks assume the same duties. The eggs have a light bluish white background, and are absolutely clouded with shades of light brown and lavender.

"Of 65 stomachs examined, 2 contained small birds; 15, mice; 13, other mammals; 30, insects." (Fisher.)

360. SPARROW-HAWK. *Falco sparverius sparverius*.
10 in.

The Sparrow-Hawk, often called "Killy Hawk," from its call "killy-killy-killy-killy," is the commonest and smallest of our hawks. It lives largely upon insects, such as grasshoppers, crickets, beetles, and caterpillars. The call of this little falcon is much more alarming than his presence, while some of our savage raptors are comparatively silent birds. The sparrow-hawk is found throughout the entire American continent, but the form inhabiting the regions west of Kansas and Dakota is known as the desert sparrow-hawk. The birds prefer an elevated perch for a lookout, and also have the habit of hovering

almost motionless in midair, then suddenly swooping down to the ground to capture an insect or a mouse. From this habit comes the name mouse hawk, a name more often applied to the shrike.

The natural nesting site is a hollow tree, preferably near water. Sometimes the birds take possession of an excavation originally chiseled by a woodpecker, and again a natural cavity is utilized. In the Yellowstone Park region of Montana, the western sparrow-hawk frequently takes possession of a magpie's nest. In Ohio these birds have been found nesting in the crevices of stone quarries. Sometimes they lay their eggs on the sawdust between the partitions in an icthouse, usually just beneath the eaves.

Four or five eggs are laid usually in May. The background is white and the shell is delicately clouded and spotted with pale brown or salmon.

"Of 320 stomachs examined, 1 contained a game bird; 53, other birds; 12, mammals; 12, reptiles or batrachians; 215, insects; 29, spiders; and 29, empty." (Fisher.)

364. OSPREY. *Pandion haliaetus carolinensis*. 23.1 in.

This is the famous Fish Hawk, inhabiting the entire United States, but common only in certain sections near large bodies of water. Fish hawks are common along the Atlantic coast especially in Georgia, and from New York north to the St. Lawrence River. On the Pacific coast they are familiar objects on the islands opposite California. Distinctly fish eating birds, water is an essential environment. They also exhibit a preference for ocean exposure, no doubt because fishing is easier. Silently and rapidly they move over the water at a height of about forty feet, until some member of the finny tribe is discerned close to the surface. Instantly the great wings are closed, and the osprey plunges head foremost into the depths, often completely disappearing from view. In a second he arises with a fish in his talons, and with a scream of triumph flies to his nest or some favorite log or limb, which is used as a lunch counter.

You or I may not be the only witness to this performance. The bald eagle from his elevated perch has intently watched the proceedings, and his time to participate now presents itself. Immediately he starts in pursuit of the fish hawk, and the latter, terrified at the onrushing bird of greater size, drops his catch to lighten his weight, thus facilitating his escape. No sooner does the fish leave the osprey's claws than the eagle plunges downward, grasping the prize before it reaches the water.

Along the shores of the Great Lakes this bird frequently spends the summer. The Indians regard it as a bird of omen.

As the waters gradually freeze this bird moves southward, wintering along the gulf, and sometimes in the West Indies.

The nest of the osprey is a huge structure. The birds select various nesting sites, trees, rocky cliffs, or the bare ground. When the nests are placed in low situations, the birds select an isolated island or a point of land jutting out into the water. Sometimes an old shack or shanty looks inviting to the fish hawk, and he constructs his nest of sticks, cornstalks, roots and hay on the roof. The same nest is used year after year, and the birds accumulate fresh material each season until the nests are sometimes five feet deep and as many feet in diameter. The two to four, usually three, eggs vary greatly in coloration. The background may be light yellow, light or dark brown, and the markings are in form of spots and cloudings of different shades of red and brown. The eggs appear oily and usually have a decidedly fishy odor.

10. EAGLES AND OWLS.

The Eagles, found on Chart 10, properly belong with the hawks, since an eagle is only a larger hawk; the eagles are placed here because Chart 9 is crowded.

Barn owls are similar to other owls in habits and structure, but constitute a different family. Owls are found

in all parts of the world, about twenty inhabiting North America. They resemble hawks in beaks, in talons, and in carnivorous habits, but have eyes directed forward. The eyes are fixed in sockets, so that the entire head must be moved to change the center of vision. This gives them a droll, wise look, which makes the owl an emblem of wisdom. The prey is seized with the talons, and swallowed whole, hair, feathers and bones, and the indigestible parts are later expelled through the mouth in the form of pellets. A peculiarity of the foot is that the outer toe is reversible. Owls, except those ranging far north, are nocturnal, while hawks are diurnal. The cry of the owl is so weird as to create a superstitious dread. The eggs are uniformly white and unmarked. The plumage is long and loose, so that the flight is noiseless. Owls feed largely on destructive rodents; little poultry or few useful birds are destroyed by any except the horned owl. Owls are therefore of even greater economic value than the hawks.

QUESTIONS.

Why should owls rather than hawks use hollow trees? Why the loose plumage of owls? Why need not hawks have noiseless flight also? How can you demonstrate the value of the owls to farmers by showing them the regurgitated pellets? What is connecting link between hawks and owls? Why? Why is great horned owl so called? Are the projections really horns? Why is the barn owl so called? Why so useful? What is the "monkey-faced owl"? Why names: screech owl? "hoot owl"? What popular superstition connected with burrowing owl? Why does the snowy owl have white plumage in winter? Why light mottled coat in summer? What is there about the Arctic seasons that would make this bird diurnal? What other owls are diurnal? Do they also range north? What other nocturnal birds do you know? What of size of their eyes? Why? What of color? Why should nocturnal birds be better protected by colors than diurnal? Why have noiseless flight?

349. GOLDEN EAGLE. *Aquila chrysaetos*. 30 to 35 in.

The legs of this great bird are densely feathered down to the base of the toes, distinguishing it from our bald eagle. The golden eagles are occasionally recorded during the winter months in the Great Lakes region. Like the snowy owl and raven, they appear in the central United States only when the earth is covered with snow. At this time of the year food is scarce, and formerly many fell victims of the trappers while stealing bait.

Golden eagles are common winter residents in the foothills of Nebraska and South Dakota, where they feed on jack-rabbits, and also smaller rodents. They are useful birds, though they do destroy some birds and game. Generally speaking, these birds are silent. When the nesting site is approached, the golden eagle retreats without protest and remains at a safe distance until the trespasser has departed.

Mountainous regions are most frequented by golden eagles, although the nests are often placed not to exceed fifty feet above the ground in the crotch of a large tree standing in a remote canyon. The immense nests are constructed of sticks, sod and coarse grass. Two or three white eggs splashed and blotched with lilac, pale brown and chestnut are laid in February and March. The younger birds appear to deposit the largest eggs. The period of incubation is between four and five weeks, and the young do not leave the nest until they are nearly one hundred days old. The female eagle performs the duties of incubation, and is supplied with food by her mate. Golden eagles remain paired for life, and often attain the age of seventy to one hundred years.

352. BALD EAGLE. *Haliaeetus leucocephalus leucocephalus*. 32.8 in.

It is true that most mountainous regions are inhabited by eagles, but the birds also live in the flat sections where the country may be sparsely settled.

Bald eagles range from the Atlantic to the Pacific

south to the Gulf, and northward to the Arctic Circle, breeding practically throughout their range. Naturally species which inhabit the more rigorous sections of our continent are the hardiest birds, and on examination the eagles captured from the Great Lakes region north to Alaska are found to average several inches longer than those of the South, called respectively northern bald eagle and bald eagle. Several pairs of bald eagles still roam over the northern portions of Indiana and Illinois along the Kankakee and Illinois Rivers. The white plumage on the head is not acquired until the bird has attained the age of three or four years. The birds remain paired for life.

The eagles which sometimes wander from their regular habitats and cause excitement in districts where seldom seen, are generally the immature birds foraging about the country. The stories that they attack and carry off infants are untrue, as in many ways the bird lacks the courage and dash of the smaller raptors.

Along the seacoasts the eagle frequently becomes a parasite, living upon the fish which the osprey captures; while some subsist mainly on dead fish cast up by the waves, though in winter they feed extensively on water fowl. This bird has been selected as our national emblem. "Old Abe," the war eagle carried through the Civil War by the 8th Wisconsin regiment, is the most noted bird of history. The flight of the eagle is strong and rapid; it appears most majestic when soaring in great circles high in air, while uttering the noted piercing scream.

The bald eagles are common in Florida where they begin nesting late in November, household duties claiming their attention for many weeks. Their nests are massive structures, sometimes a result of many years' accumulation, since the birds annually add to the structure until some nests are five feet in depth and as many feet across. Sticks, corn husks, hay and sod are used in the eery, which is slightly hollowed. Often the structure is situated in the upright crotch of a large dead tree, near the top. Only two or three pure white globular eggs are laid.

365. BARN OWL. *Aluco pratincola*. 18 in.

The Barn Owl, or Monkey-faced Owl, is distributed throughout the United States, Mexico and northern West Indies. The birds are more numerous south of the Ohio River, and are also common along the Pacific coast in California. They are known locally as "White Owls," and frequent the bottom lands adjoining the Scioto River, breeding most commonly in the large sycamores which line that stream.

Mr. Dawson in his book, "Birds of Ohio," writes:

"Some idea of the bird's usefulness in the community is conveyed by the 'pellets' or little spheres of indigestible matter ejected by the owl from time to time. I examined many of them, and found them made up entirely of the hair and bones of the smaller rodents, mostly mice. There must have been the debris of several thousand mice and rats." Captain Bendire is certain that the captures of a single pair of barn owls, during the nesting season, exceed those of a dozen cats for the same period.

The barn owl, as its name indicates, often passes the day in barns or outbuildings, being drawn thither solely by the abundance of mice. It offers no violence to the poultry, not even to the pigeons which often share its quarters. When disturbed during its slumbers it makes a hissing noise, or clicks its mandibles in a threatening way. It has besides a "peevish scream" and some querulous notes. Its very odd appearance arouses interest in the average farmer's boy, who discovers in him a curiosity, which is too seldom satisfied until this best mouser is killed.

Of the breeding habits, Capt. Charles Bendire says: "The barn owl, strictly speaking, makes no nest. If occupying a natural cavity of a tree, the eggs are placed on the rubbish that may have accumulated on the bottom; if in a bank, they are laid on the bare ground and among the pellets of fur and small bones ejected by the parents. Frequently quite a lot of such material is found in their burrows, the eggs lying on and among this refuse. Incubation usually commences with the first eggs laid, and

lasts about three weeks. The five to nine eggs are almost invariably found in different stages of development, and young may be found in the same nest with fresh eggs. Both sexes assist in incubation and the pair may sometimes be found sitting side by side, each brooding a portion of the eggs."

366. LONG-EARED OWL. 14.8 in.

One of our commonest birds among this nocturnal family, the Long-eared Owl is resident from the Atlantic to the Pacific. The ear tufts are conspicuous and the bird may justly be called horned owl, but in size it is smaller than the true horned owl.

367. SHORT-EARED OWL. *Asio flammeus*. 15.5 in.

The Short-eared Owl, or Prairie Owl, is common to both the Eastern and Western continents, inhabiting the United States from the Atlantic to the Pacific, hence is almost cosmopolitan.

This owl is less nocturnal than others, excepting the snowy and hawk owls; as the two latter species are inhabitants of open territory and range north, they naturally have little opportunity to escape the daylight during the summer months. Like the marsh hawk it destroys great numbers of mice, meadow moles and other injurious rodents. Many fall a victim to gunners who are so ignorant and cruel as to shoot anything that comes within range. Despite the bird's size the flight is noiseless.

Five to eight pure white eggs are deposited on the ground usually at the base of a clump of grass. The eggs are laid early, usually before the verdure appears. It is remarkable how these birds can successfully hatch their eggs and rear their young on the bleak prairies of Minnesota and Dakota in April, when the only shelter is a tussock of dead grass.

When the young have hatched, the old become very uneasy about the nest at the approach of a stranger, circling about, and alighting in the grass a short distance



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away, while continually uttering an alarm note which sounds like the whine of a puppy.

373. SCREECH OWL. *Otus asio asio*. 9.4 in.

The Screech Owl, sometimes known as the Little Horned or Red Owl, ranges throughout eastern North America. The most abundant of our owls, it is the smallest variety inhabiting the eastern United States, excepting the rare saw-whet owl. The plumage regardless of age or sex may be the common phase, a dark gray, or a rufous brown. The "red phase" shown in the study is the rufous brown. These birds in some phase may be found in every portion of the United States, being divided by naturalists into about fifteen sub-species, each having a given range, such as Florida screech owl, Texas screech owl, Mexican screech owl, California screech owl, Rocky Mountain screech owl, etc. The territory inhabited by the common form is the region east of Kansas, across the continent to the Atlantic and as far south as Georgia.

The notes of the screech owl are weird and more uncanny than even those of the other species. Like the howl of the coyote or the cry of the loon, there is something suggestive of human distress or agony in these notes. The quavering notes on the darkest nights may induce a superstitious dread, but the birds deserve full protection as they are highly beneficial because of their destruction of mice and other rodents and beetles.

The birds, usually resident throughout the year wherever found, have the habit of frequenting deserted buildings, often laying their eggs in some corner of an old barn or shed. Typical nests are placed in deserted woodpecker excavations or hollows in trees and stumps. Three to six pure white eggs are laid in April.

375. GREAT HORNED OWL. *Bubo virginianus virginianus*. 22 in.

The Great Horned Owl, or Hoot Owl, is resident throughout eastern North America from Labrador to Costa Rica. It is one of our four American birds con-

sidered decidedly detrimental to the interests of man. The Department of Agriculture and the Biological Survey have both condemned this bird and imposed the death sentence upon him. The food in many instances is taken from barnyards, consequently poultry enters largely into the bill of fare; many pellets too are found to contain the feathers and bones of our most valuable wild birds, such as the bob-white and ruffed grouse. In other instances I have known horned owls to live in some hollow tree overlooking a corn crib or granary where they subsist on rats.

The notes of the horned owl are a deep and loud "hoot," uttered particularly during inclement weather or before a storm, for in districts inhabited by these owls one seldom fails to hear the weird hootings when the barometer indicates a change of weather. It seems hard to imagine one of these solemn-looking birds that stand so erect, sitting horizontally on her nest. However, they assume this position with ease, and the naturalist venturing forth into the snowbound wood in February uses his field-glasses to detect the two tufts of feathers, the only telltale signs that some old hawk's nest is occupied by this big bird.

The household duties of these hardy birds are commenced during the coldest days of February. Frequently an old nest of the great blue heron, red-tailed or red-shouldered hawk is used. Two to four pure white eggs are laid. Often the eggs are deposited in a hollow tree, where only a few feathers separate them from an ice foundation at the bottom of the cavity.

376. SNOWY OWL. *Nyctea nyctea*. 25 in.

The Snowy Owl breeds from Labrador northward, and wanders southward in winter into the northern United States.

Like the hawk owl, it is diurnal in its habits, but is most active in early morning and again about dusk. Like the hawk owl, too, it occupies a commanding perch for

hours on the watch, occasionally dropping on a rodent or sailing about, soon to return to the same perch.

"During January and February of 1902, there occurred a remarkable invasion by snow owls, reported from localities as diverse as southern Michigan and Long Island. They were especially abundant in Ontario, and were much sought for their plumage. According to Mr. Ruthven Deane, "a Mr. Owens, taxidermist, living near Mooresville, Middlesex County, received and mounted twenty-two specimens during the winter, and commented on the fact that thirteen years ago he prepared exactly the same number, not having handled a single specimen during the interim." Mr. Deane collected information of more than 430 of these owls that were killed during this one flight.

"The home of the snowy owl is on the immense moss and lichen covered tundras of the boreal regions, where it leads an easy existence, finding an abundant supply of food during the short Arctic summers. Hunting its prey at all hours, it subsists principally upon the lemming, and it is said to be always abundant wherever these rodents are found in numbers. Other small rodents are also caught, as well as ptarmigan, ducks and other water fowl, and even the Arctic hare, an animal fully as heavy again as the owls." (Bendire.)

This great bird nests on the ground, laying from three to ten eggs.

377a. HAWK OWL. *Surnia ulula caparoch*. 15 in.

The Hawk Owl is a handsome bird, shaped after the manner of our falcons, but the position of the eyes, shape of the tail and habits of the bird are more in keeping with those of owls. In habits, plumage and structure, it is the connecting link between hawks and owls. Its flight is swift and hawk-like but noiseless; however, these birds see readily in daylight and are abroad in midday, even in our brightest weather. Their favorite haunts are in the northern portions of both continents, and only during the coldest weather do they find their way southward to the

northern border of the United States. Their food is chiefly small rodents. In the fur country about Hudson Bay and the Anderson River region these birds nest quite commonly. The native fishermen experience perpetual daylight during May, June and July; it would therefore seem that the hawk and snowy owls, being inhabitants of the land of the Midnight Sun, are of necessity diurnal. When starting from a high perch the hawk owl pitches down to near the height of bushes or grass, and flies off just over the top of the grass.

The nests, usually placed in coniferous trees, are composed of sticks, twigs, lined with hay, moss and a few feathers, wherein four to six white eggs are laid. This bird at times deposits its eggs in hollow stumps, after the manner of the screech and barn owl.

378. BURROWING OWL. *Speotyto cunicularia hypogaea*. 9 in.

The Burrowing Owl, one of our smallest owls, confines its range to the prairies and great plains from Missouri, Kansas and Dakota westward. The southeastern form known as the Florida Burrowing Owl inhabits the Bahama Islands and portions of Florida. The burrowing owl has become popular through various sensational articles describing the contents of a burrow on the cheerless prairie, as being shared by this little bird, the prairie dog and the rattlesnake. It is true that burrowing owls, like prairie dogs, are found in communities, and inhabiting sections of the prairies that are perforated with burrows suitable for nesting sites; often holes constructed by mammals are utilized. It should be distinctly understood, however, that these owls choose only the abandoned burrows of rodents, principally those of the prairie dogs. Their nesting places are not shared by other creatures, unless an unwelcome guest should intrude. It is a common occurrence for a number of the owls to congregate and nest together, entering and departing from a single burrow. The males are kept busy supplying their mates with mice, small birds,

and grasshoppers, so that this dirty little bird is a highly useful one.

Frequently the eggs are deposited on the bare earth, but if weeds, grass or other material is available, the birds usually accumulate a small quantity on which to deposit their five to nine pure white eggs. Around the outside of the nest may be found the trophies of these little hunters. Skins of gophers, rats, mice and remains of small rabbits are common.

11. WOODPECKERS.

About twenty-five species of Woodpeckers are found in North America. The feet have two toes extending forward and two backward. All toes are strong and equipped with long, sharp claws; the bills are strong and chisel-like. They are arboreal though the Flicker is found often on the ground searching for ants. The tail feathers are stiff, ending in spines for propping the bird; the tongue is distensible and has a horny spear-like tip suitable for probing into the holes of wood larvæ in order to spear and withdraw these grubs. See Chart 48 of Study. These birds are of great economical value to agricultural and horticultural interests. The mate call includes the drumming with the bill on the dead trunks or limbs of trees. Eggs are uniformly white and placed in holes usually hollowed by the bird in the trunk of a tree.

QUESTIONS.

Of these birds which are summer residents? Which winter? The state of Washington has adopted a woodpecker for the seal. Why is it appropriate? What other birds climb about on trunks and limbs of trees? Do they obtain food by pecking into the wood? What of value of woodpeckers as home builders for other birds? What of color of feathers on the head? What other birds use tail

as prop? Which use the sap as a lure for insects? Which one feeds upon ants? What of wisdom of shooting them? Name two of species of winter residents that enjoy each other's company? Which woodpecker catches insects similar to the flycatchers?

349. DOWNY WOODPECKER. *Dryobates pubescens medianus*. 6.8 in.

The Downy Woodpecker is often mistaken for the hairy woodpecker from which it differs only in size and minor markings, one plate on the Study answering for both. It ranges throughout eastern North America from Labrador to Florida. A rugged little climber, it is resident the year round wherever found. There are several forms of this species: the southern downy, Gairdner's, Batchelder's downy, willow, and Nelson's downy woodpecker. It is like splitting hairs to distinguish one from the other, except that they are usually classed according to their locality or range. Practically every section of the United States and Canada contains one of the above forms.

Sociable little birds, during cold, wintry days, they often visit the dooryards in company with chickadees and white-breasted nuthatches. Many observers attract these birds to their window-sills by tempting them with suet. They should be attracted to orchards by feeding them suet, etc., so as to have the benefit of their search for insects, and their eggs and larvæ. This bird is highly beneficial to the interest of horticulture. Prof. Beal of the Biological Survey, United States Department of Agriculture, reports it as the most beneficial of all woodpeckers, in spite of the fact that it is also the smallest. Seventy-five per cent of its food consists of ants, beetles, bugs, caterpillars, and grasshoppers, partaking only sparingly of wild fruits.

The eggs are deposited on an accumulation of rotted chips and dead wood at the base of a hollow limb or tree trunk which is dead and often soft from decay. The eggs, like those of all other woodpeckers, are pure white with a glossy surface.

393. HAIRY WOODPECKER. 9.4 in.

The habits, haunts and color of the Hairy Woodpecker is almost identical with that of the downy woodpecker. The hairy, however, has a more northerly range and is a less common species. In size it is several inches longer than various forms of the downy woodpecker. One plate is thought sufficient to show both.

397. NUTTALL'S WOODPECKER. *Dryobates nuttalli*. 10 in.

Nuttall's Woodpecker has a restricted range, being found only in California. In size and habits it is similar to our downy woodpecker. Orchards, stumps and fence rails are persistently inspected for insects and their larvæ.

Mr. B. T. Gault of Glen Ellyn, Illinois, found this bird in the San Bernardino Valley of California. Notwithstanding various loud demonstrations, such as tapping on the tree trunk and chopping into the cavity with a hatchet, the female did not leave the nest until finally removed by hand, when she appeared stupefied.

401. THREE-TOED WOODPECKER. *Picoides americanus americanus*. 9.5 in.

The Three-toed Woodpecker is resident through Canada and into northern United States. It has the peculiar structure of only three toes on each foot.

"It is a restless, active bird, spending its time generally on the topmost branches of the tallest trees without, however, confining itself to pines. Its movements resemble those of the red-cockaded woodpecker. Like it, it will alight, climb along a branch, seek for insects there, and in a very few moments remove to another part of the same tree, or to another tree at more or less distance, thus spending the day in rambling over a large range. Its cries also somewhat resemble those of the species just mentioned, but are louder and more shrill, like those of some quadruped suffering great pain. It very frequently makes sorties after flying insects, which it secures in the air with as much ease as the red-headed woodpecker.

Besides insects it also feeds on berries and other small fruits.

"Its rapid, gliding flight is deeply undulated. Now and then it will fly from a detached tree of a field to a considerable distance before it alights, uttering at every glide a loud shrill note.

"The nest of this species is generally bored in the body of a sound tree, near its first large branches. I observed no particular choice as to timber, having seen it in oaks, pines, etc. The nest, like that of allied species, is worked out by both sexes, and takes fully a week to complete, its usual depth being from twenty to twenty-four inches. It is smooth and broad at the bottom, although so narrow at its entrance as to appear scarcely sufficient to enable one of the birds to enter. Only one brood is raised in the season. The young follow their parents until autumn, when they separate and shift for themselves." (Audubon.)

402. YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius*. 8.6 in.

The Yellow-bellied Sapsucker ranges throughout eastern North America; breeding in Massachusetts, Illinois and north; wintering from Virginia to Central America.

This is the only sapsucker occurring east of the Great Plains. In summer it may be found occasionally in the northern portions of Illinois and Indiana. Quite a few of the birds nest in the vicinity of Detroit, Michigan, and I have personally observed them during the breeding months in northern Wisconsin. Fifteen years ago the yellow-bellied sapsucker nested along the river bottoms of the Illinois and Kankakee Rivers, but today they are rarely seen during the breeding season in this latitude. By many ornithologists the yellow-bellied sapsucker is considered the handsomest of our American woodpeckers.

The woodpeckers of this genus are the only ones to which the terms sapsucker may with any propriety be applied. They lack the long extensile tongue which enables the other species to probe the winding passage made

by larvæ. The sapsuckers are found feeding largely upon the sap and inner bark of trees; they also feed upon insects attracted by the sap. In some localities they injure valuable timber by chipping off bark and girdling the trunk and larger limbs with small holes. This handsome bird devours many insects, but its fondness for the sap of trees, including apple and other orchard trees, with its habit of cutting out sections of the bark to obtain its favorite tippie, renders it injurious in some localities. It is one of a number of birds that are harmful and beneficial by turns, or according to locality. Little blame attaches to the orchardist who blacklists the sapsucker, but he should familiarize himself with the other woodpeckers that he may distinguish this from other kinds.

The birds often excavate a nesting site in living trees, but in the mountainous regions of New Hampshire and Maine the birds exhibit a decided preference for dead birches. The average height of the excavation from the ground is about forty feet. Many of the nests are gourd-like in shape with sides very smoothly and evenly chiseled by both sexes, usually to the depth of about fourteen inches. Three to seven pure white eggs are laid.

405. PILEATED WOODPECKER. *Phlæotomus pileatus pileatus*. 17 in.

The range of this noble bird was formerly the whole wooded region of North America.

"If the 'curse of beauty' be added to that of large size, the destruction of a bird is foredoomed. This magnificent black woodpecker, once common throughout the heavily timbered areas, has almost disappeared before the industrious axe and the all-conquering gun, and the day of the passing of the 'Logcock,' or 'Lumberjack,' is not far distant.

"In the spring of 1902, according to Mr. Sim of Jefferson, Ohio, a pair of these birds nested within a mile of town. The nesting cavity was dug by the middle of April, in a beech tree, at a height of about thirty feet. Chips were strewn liberally over the ground below, and many

showed characteristic chisel marks of the bird's powerful bill. During the nesting season the birds remained near, drumming, calling and feeding. The flight, unlike that of other woodpeckers, is direct and not undulating.

"The drumming song is a series of about twelve taps, increasing in rapidity and growing less in strength to the end. I have heard this woodpecker give three vocal songs or calls. One is an exultant, ringing laugh; at a distance this call sounds metallic, but when at close range it is the most untamably wild sound that I know among the bird-notes. Another call might be suggested by the syllables cow-cow repeated indefinitely, but sometimes intermittently, resembling the flicker's call. When two birds approach each other they often carry on a wheedling conversation, analogous to the 'Wichew' note of the flicker, but it is so given as to lead one to believe that the birds have their bills closed while making the sound.

"In its search for food the logcock strikes deliberately, but with force, often giving the head a powerful twist to wrench off a piece of wood. Sometimes quite a large fragment is thrown back by a toss of the head. Much time is also spent about fallen tree-trunks, where in addition to grub and other insect larvæ, it subsists largely upon ants." (Dawson.)

406. RED-HEADED WOODPECKER. *Melanerpes erythrocephalus*. 9.5 in.

The Red-headed Woodpecker, abounding throughout eastern North America, is readily recognized in the adult plumage by the red head, and white under parts, with the steel blue and white covering. The red-headed woodpecker is found as far west as Colorado, sometimes California. In summer it may be met with as far north as Ontario and Quebec, but is rare east of central New York. It is a striking bird when seen at a distance moving about the trunk of a dead tree or telephone pole. Usually the nests are cavities chiseled into dead tree trunks, though the birds may use living trees. The young in the first plumage are marked by the absence of red on the head.

Woodpeckers generally are of great value in their protection to trees, but the red-headed woodpecker is of greatest value, as he enjoys nothing more than a meal of young English sparrows just out of the shell. These birds often wedge acorns into cracks in trees and later extract the kernel; or an acorn is sometimes pounded to a meal and eaten, or the bird awaits development of larvæ in the acorn and eats that. They often catch insects on the wing as do flycatchers.

The birds often alight on a metal cornice or projection and call to their mates, alternately drumming and calling vocally. The flight of all woodpeckers is characteristic; they pursue an undulating course; flying perhaps 50 feet until the wings close and they drop a few feet again regaining themselves. While generally regarded as migratory, if he finds plenty of food, such as beech nuts, he may winter in northern United States.

Four to six white eggs are deposited in cavity chiseled from a dead tree.

407a. CALIFORNIA WOODPECKER. *Melanerpes formicivorus bairdi*. 7.4 in.

The California Woodpecker and a closely allied subspecies known as the ant-eating woodpecker, are inhabitants of California. The plumage is chiefly black, while on the crown is the customary scarlet patch, common to the males of most woodpeckers.

The California woodpecker has the habit of storing away acorns almost as persistently as do our squirrels. The birds select partially decayed trees and perforate the bark and trunk with small holes into which they securely wedge these acorns, feeding upon them and especially the larvæ they contain, during the winter months. In New Mexico these birds seem partial to small oak groves. In the Catalina Mountains of Arizona, they may be met with at an altitude of 4000 feet, living both in the pine and oak groves. Frequently a natural cavity is used as a suitable site for the eggs and young. Perhaps their habit of drilling small holes for the storage of acorns causes

this bird to become less active in chiseling a cavity large enough to contain a setting of eggs. When the birds excavate holes for nesting sites, a situation on the under side of a limb is frequently chosen. Sometimes they successfully drill a hollow in a living tree.

Four or five white eggs are laid in April or May.

409. RED-BELLIED WOODPECKER. *Melanerpes carolinus*. 9.5 in.

The Red-bellied Woodpecker ranges throughout eastern United States; nesting north of Massachusetts and Minnesota; wintering from Virginia and Ohio southward.

"For the coincidence I shall not try to account, but it is a fact that whenever the bird-man clears the snow from a log where the wood-choppers have been at work, and sits down after a long morning's work with the birds, to a shivering midwinter lunch, the red-bellied woodpecker, till then silent, bestirs himself and begins to pout 'chow-chow-chow.' Careful attention discovers the pouting hermit taking his brief nooning in the middle heights of a twined tree-trunk, or else darkly silhouetted against the wintry sky. Here he hitches and grumbles by turns.

"To me there is something uncanny about this ascetic bird, who whiles away his winter hour in the seclusion of a narrow cell; and in spring, scarcely less unsocial, retires to the least frequented depths of the forest to breed. Far from the haunts of man, and secure in the protection of abundant leafage, the birds do unbend somewhat. At this season they have a chirruping cry, which only the experts can distinguish from the noisiest of the red-head's notes; and another, a very startling expression of mingled incredulity and reproach, 'Clark.' This is evidently analogous to the red-head's 'Queer.'" (Dawson.)

The nest is usually placed in holes some twenty feet from the ground, where four to six eggs are laid.

412. FLICKER. *Colaptes auratus auratus*. 12.5 in.

The red on the head, the black crescent on the cinnamon brown breast, the yellow lining of wing flashing in

undulating flight, and white spot on rump are striking field marks.

The Flicker, Yellow Hammer, Wake-up, or High-hold, known by no less than thirty-six names, is probably the commonest woodpecker on this continent. The northern or common flicker occurs in the eastern United States, north of the Ohio River and west to the Rocky Mountains. It is a hardy bird and though migratory does not pass beyond the borders of the United States except during severe winters, when some of them may be met with in Central America and Mexico. Among the first harbingers of spring, the budding of the catkins and the flight of the flicker are conspicuous.

The males are droll creatures and so ardent in their wooing that they become unsuspicious of mankind. Three, and often five, yellow hammers may be seen ardently courting the same female, whose absence of red on the nape of the neck makes her identity certain. The flicker beats a rolling tattoo in spring. His vocal song proper is a rapid, oft-repeated "cuh-cuh-cuh." It also has a "wee-chew-wee-chew" song, from which comes its name "flicker." The quest of ants has led this bird to terrestrial habits, so that it seems to be gradually becoming a species of grouse. It is a very useful bird and should be protected even though it may be fond of cherries.

In June, 1896, I noticed a flicker emerging from a hole in an apple tree. Examining the cavity I found two eggs resting on bits of decayed wood fourteen inches below the entrance. I removed one egg, leaving the other as a "nest-egg." Returning day by day, repeating the operation during a period of forty days, when the female had deposited twenty-nine eggs. On one or two occasions there was an interval of three days between laying.

The nesting site is often a cavity which is originally dug by the birds in their quest for ants and larvæ. During the labor of excavation the season for maternal duties arrives, and the birds utilize the same tree on which perhaps half a dozen woodpeckers have been more or less dependent for a living. Five to nine eggs are usually laid.

In the South Atlantic and Gulf States, we have another form slightly smaller than the northern flicker and a little darker in color. Colorado and the territory immediately westward is the home of the red-shafted flicker, a bird whose wing quills are bright crimson, instead of yellow.

12. CLIMBERS AND GOATSUCKERS.

Paroquets belong to the parrot family. Of the five hundred species of this family, only one, the Carolina Paroquet, inhabits eastern North America, as most species are confined to the tropics. Two toes extend forward and two backward. The bill is strong and decidedly hooked, the upper mandible being movable and used in climbing. These are arboreal, fruit eating, seed eating birds of bright plumage. They are good climbers and strong fliers. Almost all varieties of parrots can be taught to speak.

Mr. Frank M. Chapman says: "All cuckoos have two toes directed forward and two backward but the cause or use of this characteristic is difficult to understand, so widely do the members of this family differ in habits. Some are arboreal, never visiting the earth; some are terrestrial, running with great swiftness and never perching far above the ground. Most cuckoos—all our thirty-five American species—have noticeably long tails which they raise and droop slowly just after alighting, or when their curiosity is aroused. Of the 175 known species, only two are found in the northeastern states. Cuckoos are mysterious birds well worth watching. I would not imply that their deeds are evil; on the contrary, they are exceedingly beneficial birds. One of their favorite foods is the tent caterpillar which spins the destructive 'worms' nests' in our fruit and shade trees. Indeed, we should be very much better off if cuckoos were more numerous."

Kingfishers are fishing birds in America, though some Old World species are insectivorous and also feed on mollusks. They are solitary birds of local habits.

Nighthawks, whip-poor-wills, swifts and humming-birds are found in the same order, though in different families. Nighthawks and whip-poor-wills belong to the goatsucker family. Only seven birds of this family reach North America. Most of them live in forests, perching lengthwise on the branches of trees in imitation of knots. The nighthawk is often found in treeless regions as well. Color protection of all species is strongly marked. Birds of this family capture their insect prey on the wing, aided by their large mouth, and in some species further helped by the stiffened bristles at the side of the mouth. Most of the birds of this family utter weird notes, especially the whip-poor-will. The feet are weak but flight is strong.

Swifts secrete glue from the throat in order to fasten sticks together to make their nests. The young are fed by regurgitation. Swifts are diurnal, while goatsuckers are nocturnal. Swifts are generally gregarious. While formerly using hollow trees, they now use chimneys almost exclusively. They feed while flying, never alighting except in the chimneys. The resemblance to swallows is only superficial.

Humming-birds are confined to the New World. Of the four hundred known species, only one, the ruby-throated, nests east of the Mississippi River, though the rivoli may be seen in eastern United States after nesting season. Humming-birds feed on the wing. While feeding on insects they also partake of the nectar of the flowers, using long beak as tube. The flight is insect-like and is unequalled for number of strokes of their short wings.

QUESTIONS.

Why must the kingfisher catch the prey in the beak? Why should this bird have such a large head? Why so strong a beak? Why is a strong foot not a necessity? As a kingfisher lives almost exclusively on fish, would you think it useful or harmful to man? Does the osprey catch its prey in beak as does this bird? Why could it not do so? Has it strong feet? Mention other birds with fish spears for bills? Are they land or water birds? Is it

necessary for the osprey to have a large gullet similar to the kingfisher's? Why? What birds have upper mandible movable? Where did swifts formerly nest? How does it construct nest? Tell of structure of beak, feet, tail, wings. Where does it usually nest? How can you best study it in nesting sites? Why is poor-will so called? Why chuck-will's widow? How many syllables in each name? What kind of eyes have birds of this family? Note size. Why is color protection and position protection so necessary in nighthawks and whip-poor-wills? Would you expect a whip-poor-will to have plumage more like a hawk or noiseless like owl? Which do eggs resemble most, those of owl or hawk? Show how the weak legs and prehensile claws help whip-poor-will to protect itself from its enemies. Is their food more abundant because of nocturnal habits? Of what use are the long hairs extending from side of mouth? Why is "swift" so called? Why is name "swallow" incorrect? What other birds feed exclusively from insects taken in the air? Do you know of any other diurnal birds that feed on insects in continuous flight? What of rapidity of flight of all these forms? Has nighthawk an advantage in number of insects abroad while feeding? Why are eggs white? Why should nighthawk's eggs be colored?

382. CAROLINA PAROQUET. *Conuropsis carolinensis*.
12.5 in.

The range of the Carolina Paroquet is now restricted to parts of Florida; formerly they were found as far north as southern Ontario.

"It was not possible that in an age of guns and women, a creature of such beauty as the Carolina paroquet should have been spared to grace our landscape. Besides brilliant plumage, a dashing figure, and a strident voice, fondness for fruits and young grains, conspired to bring about the practical extermination of this once abundant bird.

"There are gray-haired men still among us who remember the shrieking companies of 'parrots' which used to haunt the bottom lands and go charging about the syc-

mores like gusts of autumn leaves; but today only the cunning plume-hunter or lucky ornithologist may penetrate to the remaining fastnesses of the species in the Everglades of Florida.

The flight of the paroquet is graceful and swift, comparable in both respects to that of the passenger pigeon. The birds formerly moved about in companies of from fifty to five hundred; and, when making extended flights or when coming down to feed, the flock fell into a V-shaped figure somewhat like that made by the Canada geese. Although awkward in confinement where their movements are restricted, the birds move easily through the branches of a tree, now swinging head downward to reach a drooping seed, now regaining the perch by the aid of the powerful beak, which is used as a third foot. The birds were especially noisy during flight and at meals, screaming and chattering, but during the middle of the day they rested or cooed tenderly as if it were the mating season. Their favorite food was the cockle-burr, which grows abundantly in low places. Besides this they ate wild fruit of many kinds, persimmons, wild grapes, pawpaws—as well as beech nuts, acorns, and the round seed-balls of the sycamore. When the settlers came, there was added wheat in the milk and cultivated fruits.

The birds roosted in great hollow trees, mostly sycamores, where the great beak, which did duty for hands and feet daytimes, rendered service as a hammock hook at night. It was in hollow trees also that they nested. They breed in the South, in colonies in cypress trees, the nest being a mere bunch of sticks placed at the forks of horizontal limbs, and containing as is supposed up to four or five white eggs. (Adapted from Dawson's "Birds of Ohio.")

It is claimed on good authority that these birds hibernated in northern latitudes.

385. ROAD-RUNNER. *Geococcyx californianus*.

This is the Chapparal cock of Texas, New Mexico, Colorado, and California. The Mexican knows him as

the paisano, or snake-killer. At first glance their appearance is suggestive of a large cuckoo. I noticed road-runners quite frequently through Texas. Entering the driveway ahead of the horses, these fleet-footed birds easily outdistanced the average traveler.

Their food consists largely of lizards, swifts and other small reptiles. The nests are often placed in cactus plants. I found one March 8, 1909, at Camp Verdi, Texas. The nest was similar in construction to the cuckoo's but much larger. Twigs, stems and grass entered into the composition, but on the whole it was a very shallow affair placed four and one-half feet up in a cedar tree by the roadside.

387. YELLOW-BILLED CUCKOO. *Coccyzus americanus americanus*. 12.2 in.

The Yellow-billed Cuckoo ranges generally throughout North America; wintering in Central and South America.

The yellow-billed like the black-billed cuckoo with the same range is highly beneficial to the interests of agriculture and horticulture. These birds destroy immense numbers of caterpillars, moths, and beetles, hence are among our most useful birds. Birds of retiring habits, living chiefly in thickly foliated bushes or trees, they are seldom seen perching on the outside branches. Like our woodpeckers, two toes extend forward and two backward. The flight is swift, horizontal and rapid. The tails are long and lightly colored at the tips, the outside tail feathers being decidedly the shortest.

Like our flycatchers, they appear from the south when the verdure has matured, and depart from their summer habitats before we have experienced our first cold weather.

The notes are a series of low tones uttered while the bird is at rest or flying from one tree to another. They might be described as "chow-chow-chow-chow" with greater emphasis on the last two syllables.

The nests are of grass and twigs with a lining of dead leaves and grass, usually built in a crotch or on a horizontal limb, sometimes in a low shrub not to exceed three feet

from the ground. Orchards, second growth and bushy pastures are favorite sites.

Two to five light blue eggs are laid in May or June. Several days may elapse between the time of laying one egg and the next one. As the parent begins incubation with the first egg, nests are often found containing both young and eggs. Sometimes the two species deposit their eggs in the same nest. The eggs of the black-billed cuckoo are slightly smaller and darker than those of the yellow-billed.

388. BLACK-BILLED CUCKOO. *Coccyzus erythrophthalmus*. 11.8 in.

The Black-billed Cuckoo and the Yellow-billed Cuckoo resemble each other in appearance and habits so closely that a single article or plate might do for both. Indeed, it is a very difficult matter to distinguish these closely related species unless one is near enough to recognize the black color of the lower bill which is the main distinguishing characteristic or slight difference in color of tail which has only inconspicuous whitish tips. The cuckoo, or rain crow, is one of our very interesting birds. It is closely related to the European cuckoo which, like our cowbird, lays its eggs in the nests of other birds; but our cuckoos rear their own young, though there is a carelessness about the nesting habits even in our own species. Mr. Frank M. Chapman says: "There is something about the cuckoo's actions which always suggests to me that he either has done or is about to do something he should not." It is more easy to hear these retiring birds than to see them as they avoid the outer branches of trees and fly from the protecting foliage of one tree directly into the middle branches of another, so that it is difficult to see them except on the flight from tree to tree.

The nesting habits of the two species are so nearly identical that the differences have already been pointed out in the descriptions of the nesting habits of the yellow-billed cuckoo.

390. BELTED KINGFISHER. *Ceryle alcyon*. 13 in.

The Belted Kingfisher breeds from the southern United States, northward into Canada, wintering from Virginia and Kentucky to South America.

The birds are partial to certain pond and creek holes, and only the freezing of the water drives them farther south, where they await the first spring thaw, returning as early as the latter part of February.

These saucy birds present a novel sight as they poise above the water and suddenly with closed wings drop head-foremost out of sight, only to appear with a minnow in the strong beak.

Probably no bird labors more persistently in constructing a nesting site than these winged fishers. In the perpendicular side of a sand or gravel bank, they burrow horizontally with one or two upward turns to a depth of from four to six feet. Several burrows are often made, one of which is used by the male as sleeping quarters. At the end of the nesting burrow, a bowl-like place is scratched, and into this the birds disgorge countless numbers of fish bones. These become bleached and the six to nine pearly white eggs may be found resting upon this crude nest of undigested matter. The eggs are usually laid in May and the period of incubation is two weeks.

417. WHIP-POOR-WILL. *Anastrostomus vociferus vociferus*. 9.8 in.

The Goatsuckers are inhabitants of both hemispheres. Whip-poor-wills breed practically from Virginia northward to the southern portions of Canada, and westward across central United States to the states bordering the plains. Another species of goatsucker, the poor-will, inhabits the Great Plains and mountainous region to the Pacific coast. The largest of the family, chuck-will's widow, occurs in the south Atlantic States. So similar are they in appearance that one plate will answer for all three species.

No order among the feathered tribe shows a greater

expanse of mouth. The insectivorous food is caught on the wing. The lining of the mouth and throat is sufficiently adhesive to hold the moths and other insects which they capture on the wing.

We see the nighthawk and hear the whip-poor-will. Any one who has not heard the notes of this bird may never identify the author whose name is taken from its notes. Much is said of the whip-poor-will's song both in prose and poetry. The vocal notes are several shrill whistles repeated rapidly, and a better interpretation may be had by repeating the syllables, "Pip-er-rip" rapidly in succession several times, not a mournful or melancholy sound as one might infer from the name. This whistle is uttered by the bird while perched on a log or horizontally on a limb. The head is moved from side to side causing the sound to vibrate from the woodland in waves.

These birds do not perch crosswise of a limb, but their bodies are parallel with the object on which they rest, head outward to resemble a knot on the branch. Their feet are extremely weak and the toes are not strong enough to allow the bird to grasp and fasten the claws to any perch. (See Chart 48 for prehensile claw.)

In migration the birds travel in small flocks, and I have frequently flushed a dozen whip-poor-wills from the underbrush in April while looking for woodcock. They do not fly until one is almost upon them, when they rise and move noiselessly through the air soon alighting on a fallen branch.

The two eggs are laid on a bare leaf in wet places where the earth is partially shaded, thus producing a mottled effect which blends effectively with the birds' plumage.

The young of the whip-poor-will are covered with fine down of chestnut-brown. The spacious mouth of the parent enables her to remove her eggs to another spot if disturbed. Like most other birds which hunt by night, the eyes are exceedingly large for the size of the bird. The wings are long and narrow, and when flat at the sides of the bird touch the ground or the object on which the bird is perching.

420. NIGHTHAWK. *Chordeiles virginianus virginianus*.
10 in.

The Nighthawk, or Bull Bat, often miscalled whip-poor-will, migrates in immense flocks arriving in the Great Lakes region about the second week in May. Many pairs spend the summer in thickly settled districts, even raising their young on the roofs of residences and office buildings in cities. Open places, rocky hillsides and stony pastures are favorite haunts, furnishing ample protection for the dull-plumaged bird. The name nighthawk is rather misleading, as the birds are not hawks, and seem to be equally at home on sunny days, cloudy weather or after dusk.

In June, 1910, I found two young on a bare flat limestone slab, where the only concealment was by means of protective coloration. The little fellows harmonized perfectly with the light and shade effect produced by old mullein stalks. The parents were very demonstrative about the young, the female feigning lameness.

The nighthawk and the whip-poor-will are often confounded or considered the same species. A careful comparison will at once show a very decided difference. The large, white patches on the five outer primaries of the wings of the nighthawk are striking field marks in flight, resembling tattered holes. At twilight or on cloudy days during summer months, great troops of nighthawks may be seen high in air over forest or town in search of insects, performing their wonderful evolutions and uttering their peevish cries, or swooping down with their strange booming or rumbling sound. Thus they continue till the gloaming merges into darkness, and their flight is seen no longer. The booming noise is made by the wind passing through the primaries in their mad plunge towards the earth. Their food is entirely insectivorous, hence it is one of our most useful birds.

The nighthawk, like other members of the family, rests on branches of trees, perched lengthwise with head outward resembling a knot on the tree. On the prairies it roosts on the bare earth, where the color perfectly harmonizes with the surroundings.

423. CHIMNEY SWIFT. *Chætura pelagica*. 5.4 in.

The Chimney Swift ranges throughout eastern North America; breeding from Florida to Labrador; wintering in Central America. These birds, commonly called the chimney swallows, are powerful fliers, and their wings in proportion to their bodies are probably longer than those of any other American bird. One of the best examples of the adaptability of the tail may be seen in the way it serves as a prop or support to the bird whose feet are otherwise too feeble securely to support the owner. Swifts are frequently seen flying in groups of three and naturalists have concluded that they may be polygamous.

One of their most remarkable traits is the manner in which they construct their nests. In former years swifts nested in hollow trees or in crevices in the rocks and cliffs; at sundown immense numbers could then be seen pouring into the top of a hollow tree, just as now hundreds will congregate in a chimney.

Western North America, particularly the mountainous regions, is still the home of several species of swifts, whose nests are fastened to the perpendicular walls of old missions, or between crevices in the rocks. Occasionally an old abandoned well is used.

It is noticeable that swifts fly higher during clear sunshiny weather, and an extreme or abrupt change in the weather may be safely forecasted when the birds are noticed skimming low over the roofs.

Their only note is an unmusical twitter which they utter when flying at top speed. The shafts in the tail extend fully one-quarter of an inch beyond the feathers, but these are not visible in flying, neither is the insignificant bill, so that one discerns merely a pair of long wings attached to a little body, and the bird might easily be mistaken for a bat.

Swifts are closely allied to nighthawks and the whip-poor-wills. They exhibit little intelligence except in the construction of their nests, and, were it not for their abundance in most sections, the birds would be little noticed by the casual observer. Their flight while strong

and powerful is not picturesque or graceful. The wing-beats are short and rapid, but the bird sometimes soars when about to enter a chimney. The outline against the sky reminds one of a drawn bow and arrow.

Accommodating itself to the advance of civilization, the nests are now usually placed on the inside of brick chimneys, though they may be found firmly glued to the inside of a barn or outbuilding. The nests are composed of small twigs which the birds snap with beak from the trees while in flight. These twigs are of about equal length, and are fastened to each other by a glue in the form of saliva secreted by the birds themselves from the throat. The nests are attached to the brick or woodwork so firmly that to remove the semicircular basket of twigs from its original place will invariably result in a portion of the brick chimney or woodwork adhering to the nest proper. They are closely allied to the Chinese swift that secretes the edible nest, regarded by the Chinese as their greatest delicacy. This interesting little bird may be studied best by placing a mirror at an angle in the chimney where stovepipe enters.

The chimney swift lays from two to five pure white long, fragile eggs. Swifts are decidedly insectivorous, feeding only on the wing. Rarely do they alight to rest and then only in chimneys, so that it may be conservatively stated that a swift spends the entire time after sunrise until sunset on the wing, except when maternal duties demand the attention.

428. RUBY-THROATED HUMMINGBIRD. *Trochilus colubris*. 3.7 in.

The Ruby-throated Hummingbird is decidedly the smallest feathered creature inhabiting North America at large east of the Great Plains; it winters in southern Florida and Central America. Many of us look upon the hummingbird as a migrant of the flower bed and gardens where they may be seen poised in air, moving their tiny wings so rapidly as to show only a blurred outline. The musical hum of the vibrating wings gives rise to the

name. While thus poised it inserts the slender tube-like bill into the long blossoms of the trumpet-creeper and other flowers for the nectar. Their fondness for the honey often tempts the little bird to nest in shade trees or saplings in close proximity to gardens, though we are apt to encounter these birds in our timbered areas far from the habitation of man, where they are earning their livelihood as all hummers originally did by capturing minute insects.

Their note is a kind of squeak or chatter less musical than the hum of its wings. The Rocky and Sierra Nevada Mountains of North America are the homes of many varieties of hummingbirds, all of which are migratory, and in some instances they may be found breeding in colonies. The males of the various species are conspicuously colored about the head with some shade of red or purple.

Ruby-throated hummingbirds are aggressive about their nesting sites and frequently disclose the presence of their abode by buzzing about the head of the intruder. I have seen the females fly with full force to about twelve or sixteen inches above the nest when the flight is suddenly checked and the bird descends like a parachute onto her nest. While the ruby-throat is the only hummingbird nesting east of the Mississippi, the rivoli wanders east of the Mississippi after nesting.

The nest of the ruby-throated is a marvel in bird architecture. It is usually placed on a horizontal limb in a deciduous tree on timbered hillsides or along streams and sometimes about gardens. Externally the nest is covered with small lichens which the bird removes from the bark of dead timber. These lichens are held in place by spiderwebs which the birds carefully weave about the nest. Down from the cottonwood and willow is used as a lining. Into this dainty receptacle two long, narrow, white eggs are laid. Two broods are reared in a season and the birds frequently use the same nest for both broods.

13. FLYCATCHERS.

Flycatchers are songless perching birds; not that they are voiceless but the vocal organs are not so highly developed as those of other perchers. This family is peculiar to America, as the Old World flycatchers differ so radically from the family found in the New World as to constitute a different family. Flycatchers are mostly tropical, thirty-five species being found in the United States. Highly migratory, these insectivorous birds seldom appear on their breeding grounds until the foliage is well under way and insect life abundant. Flycatchers with their dull plumage are generally of solitary disposition; they perch in some conspicuous place where they dart out after passing insects, then return to the same perch. They are highly beneficial to agriculture and horticulture.

QUESTIONS.

What of wisdom of killing king birds? What is its value to poultry-raiser; to bee-keeper; to agriculturist and horticulturist? Why is king bird so called? Is it an advantage to bee-keeper to have the drones killed? Why is phoebe so called? Why are they less numerous than formerly? Where do they usually nest? The birds of this group are strictly migratory; why must they migrate while the insectivorous chickadee remains throughout the year? What bird uses the cast-off skin of a snake to line its nest? As crested flycatcher nests in hollow trees what would you judge to be color of the eggs?

443. SCISSOR-TAILED FLYCATCHER. *Milvulus forficatus*. 8 in.

A singularly attractive bird readily recognized by its remarkable tail, it is common in Texas, Oklahoma and Arkansas, extending the range irregularly into many of the more eastern and more northern states. In Texas, these birds may be seen in great numbers perched on the telephone wires. They are increasing in number, a fortunate circumstance, as Texas is scourged with insects. This

bird keeps up the reputation of the family by living peaceably with its neighbors of smaller birds, while boldly driving away birds of prey.

Nests are often placed in mesquite bushes, where soft substances such as cotton, wool and rags are incorporated in the structure.

Four eggs, taken May 23, 1901, at Navasota, Texas, were placed forty-five feet from the ground in a nest loosely made of grass, weeds and stems.

444. KINGBIRD. *Tyrannus tyrannus*. 8.5 in.

The Kingbird, or Bee Martin, abundant about the Mississippi valley and Great Lakes region, ranges as far north as New Brunswick and Manitoba, wintering in Central and South America. The range extends as far west as the Rocky Mountains, where it is replaced by the Arkansas kingbird. The extreme southern portion of the United States is the home of the gray kingbird, a species resembling our common kingbird in both appearance and habits. The kingbird appears as a soberly plumaged bird with a large tail tipped with white. On close inspection, we discover a beautiful orange crown, but this color is confined to the base of the feathers on the top of the head and therefore is not distinguishable as a field mark.

Kingbirds are restless and aggressive, attacking crows, herons and hawks, sometimes alighting on the backs of these large birds and tormenting them while the intruders beat a hasty retreat. They seldom molest the cunning catbird, for as one writer states, "Kingbirds become near-sighted when attempting to pursue this retiring bird of the thrasher family." One bird observer tried to test the kingbird's pluck by flying a kite directly over a tree containing the nest. As the kingbird approached the kite, the observer gradually pulled the cord until the pursuer was almost upon the object, then suddenly released the cord and the kingbird, unable to check his flight went headfirst through the paper covering. This unexpected experience completely outwitted the saucy flycatcher, which withdrew from the scene.

These birds subsist entirely upon insect life, frequently living about the habitations of man. Farmers are inclined to kill these birds because they destroy bees. Examinations made by several of our Government experts disclose the fact that, of the bees consumed by the kingbird, 98% are drones. The bird is usually after the moths which infest the hives, it is therefore a friend of the bee-keeper; it is in fact, one of our most useful birds and deserves full protection. It is interesting to watch it dash after passing insects, snapping them up and returning to same perch, usually a dead limb.

The nests are bulky, composed of hay, twine, vegetable down, and any soft substance available. The lining is of finer material. Often the nests are placed in fruit or shade trees at comparatively low elevations. Three to five creamy white eggs handsomely speckled with lilac and purple are laid.

447. ARKANSAS KINGBIRD. *Tyrannis verticalis*.
7.5 in.

The Arkansas Kingbird, a handsomer species than our common kingbird, inhabits the United States from Kansas westward to California. Unlike our eastern species, it does not seek the habitation of man but retires to the uncultivated sections of the country, and is partial to the patches of oak or orchards overlooking the plains. Great insect destroyers, like all other flycatchers, their process of assimilation is so rapid that one can scarcely realize the quantity of winged pests they daily consume.

The Department of Agriculture made a careful examination of the crops of sixty-two of these beneficial birds, finding nearly thirty honey bees, only one of which was a worker.

The Arkansas kingbirds sometimes nest in odd situations about fences or stumps, but usually they nest in a low tree. Three to five light green eggs, spotted with purple, are deposited in bulky nests composed of weed stems, wool and hair.

452. CRESTED FLYCATCHER. 9 in.

This species closely resembles the ash-throated flycatcher of the southwest. The crested flycatcher is common through the eastern portion of the United States through the Carolinas, Maine and westward across the Mississippi. This bird nests in hollow trees and has the peculiar habit of using cast-off snake skins as a lining for the nest.

454. ASH-THROATED FLYCATCHER. *Myiarchus unerascens unerascens*.

The Ash-throated Flycatcher is very similar to our crested flycatcher of the eastern United States, so a single plate of the Study will suffice for both. The range of the ash-throated is west of the Rocky Mountains where they are comparatively common in Utah, Colorado, Nevada and Oregon. A shy bird of retiring habits, it prefers the solitude of deep shady forests where the insect food of this useful bird abounds. It is usually sole possessor of the tree in which its nest is built. Like the kingbird, this beautiful flycatcher is pugnacious, attacking all feathered intruders when they appear near the old cavity containing the nest.

Old hollows, formerly used by squirrels or woodpeckers, are favorite nesting sites. The eggs, like those of the crested flycatcher, are handsome and peculiar in markings. Four to five creamy eggs marked with purple streaks are laid, usually in June.

456. PHOEBE. *Sayornis phæbe*. 7 in.

The Phoebe, often called pewee and bridge bird, was formerly the most familiar of our flycatchers. It arrives in the Central States and Great Lakes region in advance of most other insectivorous birds. Frequently the appearance is a little premature, as our climate is subject to severe changes and it may find few insects. The breeding range extends as far north as the Hudson Bay region and west to Kansas and Nebraska. In winter it is found from North Carolina to Cuba and Mexico.

The note is a plaintive "phœ-bee" accompanied by a jerking of the tail. Sociable birds, they take readily to the habitations of man, nesting about the porches in corrals and under bridges. They do not possess the aggressiveness typical of the kingbird and crested flycatcher, but remain patiently on some twig or fence post, darting out at the insects which come within range of their sharp eyes. These highly beneficial birds are far less common than formerly, due largely to parasitic insects which often cause the death of the offspring; often when rearing the second family the quarters are for this reason changed. The English sparrow is another cause of the lessened numbers of these birds, which now seldom build about outbuildings as formerly, but select bridges, where sparrows are less in evidence.

Fifty years ago ornithologists described the eggs as pure white, but they are evidently undergoing a change as few nests now contain immaculate eggs. One or two, if not all in the set of four or five, have light reddish specks and the background is creamy instead of pure white.

Two or three broods are reared in a season, and the birds often use the same nest for all the nestlings of a season if parasites do not annoy.

459. OLIVE-SIDED FLYCATCHER. *Nuttallornis borealis*. 7.4 in.

The Olive-sided Flycatchers though comparatively rare in all sections of the United States, still range over practically the entire continent from the Atlantic to the Pacific and as far north as Greenland. Their breeding grounds are coniferous forests, usually in mountainous regions or low swampy woods. In the Great Lakes region, the bird is less common than in the New England states and through the White and Green Mountain regions of New Hampshire and Vermont. In feeding these long-winged birds usually resort to a high branch from which they dart out after every passing insect, returning to the same perch.

The nest of moss and evergreen twigs is usually placed

high up in a clump of evergreen. The background of the eggs is a beautiful deep creamy yellow, and the markings appear in the form of specks and spots of purplish brown and lilac particularly at the larger end.

461. WOOD PEWEE. *Myiochanes virens*. 6.5 in.

A sober-plumaged little bird common in eastern North America from the Gulf States northward into the southern half of Canada, while their range in latitude is from the Atlantic to the Great Plains, wintering in Central America.

Many are familiar with the melancholy notes of this little bird, but perhaps half of the casual observers are personally unacquainted with the author. The sad, sweet, prolonged note "pee-wee-peer" is uttered at various times throughout the day. "His pensive, gentle ways are voiced by his sad, sweet call, 'pee-a-wee'—the notes are as musical and restful, as much a part of Nature's hymn, as the soft humming of a brook. All day long the pewee sings; even when the heat of summer silences more vigorous birds and the midday sun sends light-shafts to the ferns, the clear, sympathetic notes of the retiring songster come from the green canopy overhead, in perfect harmony with the peace and stillness of the hour." (Chapman.)

These little birds feed largely upon insects, hence are of great economic value. They are decidedly partial to warm weather, not arriving from the South until May, when the foliage is quite dense and the damp woodlands and shady groves abound in minute insect life.

When making his first observations of birds the writer found the wood pewees common in the apple orchards about the Great Lakes region. The nests are usually cunningly concealed on low horizontal branches. Moss and lichens gathered from dead limbs and fence rails covered the outside of the nests, and these blend so cleverly with the limb on which they are saddled that detection is difficult. Ofttimes while searching for the nest both birds remain close by calling in their sweet but mournful tones. The little nests are lined with fine grass and

stems and usually contain three cream colored eggs marked about the larger end with spots of lilac and purplish brown.

463. YELLOW-BELLIED FLYCATCHER. *Empidonax flaviventris*. 5.6 in.

The Yellow-bellied Flycatcher breeds from Massachusetts to Labrador, and winters in Central America.

The Empiconaces, or gnat-kings (as the Greek name signifies), as a group offer peculiar difficulties to the bird student. Although separated into many species, the distinctions are so fine and the birds in the hand really look so much alike, that their identification is often involved in doubt and confusion.

"The keys to an acquaintance with the four species of 'gnat-kings' which occur in the East are to be found in the characteristic notes, or haunts of each. The species under consideration is the least known of the four. It is found in central United States only during migrations, when it is very quiet and very secretive. Dr. Wheaton says of its habits: 'It is seldom found perched near the extremity of limbs watching for or capturing flying insects, but it is generally seen in the midst of a low thicket or fence row, and at the first intimation that it is an object of observation, seeks further concealment by hiding near the ground and remaining motionless. None of the family are such adepts at concealment, its habits in this respect resembling those of the Connecticut and mourning warblers.'

"The ordinary note of this bird is described as 'an abrupt pse-ek, almost in one explosive syllable,' in which case it cannot be so unlike the familiar 'cle-otip' note of the Acadian flycatcher. It has, however, a more distinctive call—a soft, mournful whistle consisting of two notes, the second higher pitched and prolonged, with rising inflection, resembling in a measure chu-e-e-p.'" (J. Dwight, Jr.)

465. ACADIAN FLYCATCHER. *Empidonax virescens*.
5.75 in.

The Acadian Flycatcher, or Green-crested Flycatcher, ranges throughout eastern North America to Ontario, wintering in Central America.

In low damp woodlands the Acadian flycatcher chooses to spend the summer. Within the shadow of a single wood it finds its mate, rears its young, and gathers strength for the return to winter quarters in Central America.

The first notice which we have of the bird's arrival, sometime during the last week in April, is a fairy sneeze, heard in the depths of the wood, "Cleotip." This note comes not from the tip of some dead limb in full view, as would be the case with other flycatchers, but from a clear space on some lower limb. The bird delivers his salutation with apparent effort, and he jerks his tail at the same time by way of emphasis. His repertory of song contains no other notes save a low humming titter of adulation, common to the little flycatchers, and a sharp scolding note.

It is not altogether unusual to find the Acadian flycatcher frequenting second growth clearings, and the woodsy borders which face damp brush lots, but he is more commonly found along some unfrequented wood-road, or in the gloomy heart of the forest. Here he waits for mosquitoes and midges, darting at them suddenly from his perch, making a quick turn while bringing his mandibles together with a click.

Here, too, in some dim aisle of the forest, from the feathery tip of a branch, a frail cradle is swung. It is a shallow saucer of fine twigs, leaf-stems, or the stalks of some slender vine, made fast by the edges to forking twigs or half supported by them. Usually the materials are loosely interwoven and bound together by cobwebs. Occasionally the affair is so careless that it merits Dr. Wheaton's comparison, "a tuft of hay caught by the limb from a load driven under it."

Into the frail saucer three eggs are commonly placed. Many eggs must be lost each season, for any considerable wind would upset them. (Dawson.)

466a. TRAILL'S FLYCATCHER. *Empidonax trailli*
trailli. 6 in.

In northern Illinois and Indiana, Traill's Flycatcher is common. It is found generally distributed throughout North America, breeding from northern Illinois and northern New England to Alaska, and wintering in Central America. Considerable controversy has arisen during the last ten years as to whether the lower part of the Great Lakes region is the home of Traill's flycatcher or a closely allied sub-species called the Alder flycatcher. However, both have the same habits and their difference is hardly distinguishable except to the specialist who might have several specimens of each before him for comparison. Traill's flycatcher is a rather retiring little bird inhabiting second growth in wet places, often along streams or on the edges of our small inland lakes.

How clearly the disposition of our birds is foretold by the position in which they carry their tails! The drooping tails of the wood pewee, phoebe and Traill's flycatcher indicate a rather pensive and demure disposition, in striking contrast to the demeanor of the nervous insectivorous warblers that move from branch to branch, impulsively jerking their tails from side to side.

Traill's flycatcher is one of the last birds to join us in the spring. Like the hummingbird and scarlet tanager, it moves northward leisurely, not arriving in the Great Lakes region until well along in May.

The birds feed entirely on insects, which they capture on the wing, usually by darting from their perch at every passing fly or bug, many of which are too small to be distinguished by the naked eye, so they are highly beneficial.

While fairly common in Ohio and the New England states, their presence is seldom suspected as this bird of dull plumage appears to avoid publicity by feeding in shaded places where the verdure is dense and mosquitoes abound.

The beautiful little nest, usually placed in a fork of an upright branch not more than five to ten feet above the ground, is made of vegetable fiber, stems, Indian hemp,

and grass, lined with fine, round grass stems. Three and four cream colored eggs, daintily speckled around the larger half with light red, are laid about the second week in June.

467. LEAST FLYCATCHER. 5.4 in.

A common bird in eastern North America similar in habits to Traill's flycatcher but as the name implies, slightly smaller. It is frequently known as Chebec from the note.

14. STARLING FAMILY—CROWS AND JAYS.

The Horned Lark, the only representative of the lark family found in America, is closely allied to the skylark of the Old World. Larks are terrestrial birds, their colors harmonizing with the prairies where they are found. Except when nesting they are gregarious.

Crows, jays, magpies and nutcrackers, all members of the Corvidæ family, are omnivorous feeders, living upon both animal and vegetable foods. Many of them are not migratory, while others are migratory to a limited extent. These birds are of unusual intelligence; many of this family may be taught to speak. The starlings are Old World birds. Those found in this country have been introduced from Europe. In the East they are increasing in number to such an extent as to be a menace; hence all should be interested in their peculiarities.

QUESTIONS.

As a family what birds are regarded as most intelligent? Which bird do you regard as wisest? What of speaking ability of birds shown on Chart 14? What other birds speak? Are they also intelligent? Weigh the good and bad traits of blue jay. Of crow. How does the jay hide food? What of its power of imitation? What of its love for mischief? Is it popular in the bird world?

Why do other birds most fear it at nesting time? Is it consistent to speak of a simpleton as a jay? What bird ranges farthest north? What of color of the other far northern birds? Why are crows interesting pets? What of crow language? What is the objection to having them as pets?

475. MAGPIE. *Pica pica hudsonia*. 9.5 in.

The magpie is a handsome scamp. Like the Canada jay he is a born thief and has the same sneaking ways which other members of the crow family possess. Magpies usually confine themselves to rough or mountainous regions, chiefly from New Mexico, Colorado and Montana westward to the coast. The only other species common to the American continent is the yellow-billed magpie inhabiting the coast region of southern California.

Magpies are long-billed birds, probably handsomer than other members of the family except the jays. The flight like that of the blue jay is straight, horizontal and slow. They are very fond of feeding on the carcasses of sheep and cattle. While collecting over the stock ranges in the Yellowstone region of Montana, I always encountered magpies about the herder's camps. The birds are not so noisy as many jays despite the fact we often hear the expression, "chatter like magpies." The birds are mischievous in captivity, though they are intelligent and may be taught to speak.

The nests are remarkably large for the size of the birds. Like the oven bird and marsh wren, the nests are covered, and the only entrance is through a little hole on the side. These nests, usually placed close to the trunk of a tree, preferably a willow along creek bottoms and in canyons, are made of twigs and hay lined with any soft substance available such as wool, hair and grass.

From examining a dozen nests I judge the birds lay at intervals of from two to four days, yet incubation begins from time of deposit of first egg. In color the eggs resemble those of the yellow-headed blackbird or loggerhead shrike. The background is pale bluish white, but the

entire surface of the shell is almost completely covered with spots of light brown. These prolific birds lay seven or eight eggs.

477. BLUE JAY. *Cyanocitta cristata cristata*. 11.7 in.

The Jays, like the hummingbirds, are found chiefly in the western and southwestern portions of North America. We have but two jays inhabiting the Great Lakes region. The Canada jay is the other representative. A very handsome jay inhabits the brushy sections of Florida and is known as the Florida jay. The blue jay is common in the United States east of the Great Plains, from Florida to Canada. Throughout the year it remains in most of its range, though in the northern states its numbers are somewhat reduced in winter. During spring and summer the jay is forced to become an industrious hunter for insects for the brood, and it is not so conspicuous as when out roaming the country at will after the household duties are over.

The blue jay partakes of other birds' eggs and the young, and many farmers condemn its love for corn. Three-fourths of the bird's food consists of vegetable matter. It is difficult to decide, on summing up good and bad traits, whether to forgive the faults of this interesting scamp or to condemn and kill it.

The usual call or alarm note is suggestive of the word "Jay." The birds are clever imitators, one of their favorite pastimes being to perch near a group of chickens or other birds and then give a perfect imitation of the call of the red-shouldered hawk, varied perhaps by imitating the red-tailed and the sparrow-hawks. The result is a scurry for shelter as the jay flies away triumphantly. It delights in worrying owls and other birds, being unequalled as a tease.

Blue jays are noisy except when nesting, when they exhibit the usual cunning of the crow and jay family. Coniferous trees are used as nesting sites. In early April before the foliage appears on the deciduous trees, the jay

cleverly builds her nest among the large limbs of the tree so as to escape detection.

The nest is of small roots and sticks lined with root-lets and grass. Four or five dark green eggs are laid. The markings are drab and dark brown. Eggs from different nests exhibit considerable variation. Two broods are often reared in a season.

478b. LONG-CRESTED JAY. *Cyanocitta stelleri diademata*. 8 in.

The majority of our American jays inhabit mountainous districts in the western portions of the United States. The long-crested jay is common in the Rocky Mountains, ranging through New Mexico and Colorado. Like the blue jay it possesses a crest, which the birds erect when alarmed or agitated.

Long-crested jays are partial to coniferous trees, and in the pine districts of Arizona they are permanent residents. Noisy troops of this species rove about the canyons during the winter months, at times their notes resembling those of the eastern blue jay.

The nests are usually concealed in a mass of twigs at the top of an evergreen tree. Sticks and weed stalks are used in the construction of the nest. Four or five light green eggs marked with brown and purple are laid in May or June.

Stellar's jay, of which the long-crested is a sub-species, is confined to the Pacific coast from northern California to Alaska. The blue-fronted jay is another sub-species inhabiting the Sierra Nevada range, south of the region occupied by Stellar's jay.

484. CANADA JAY. *Perisoreous canadensis canadensis*. 12 in.

The Canada Jay, known as the Moose Bird, Whisky Jack, Camp Robber, Grease Bird or Venison Heron, is decidedly a bird of the north or Alpine region; therefore, it is found in the United States only in the northern

portion of the northern states, except perhaps in the mountainous regions of Colorado, Wyoming, and Idaho.

Blanchan writes: "The Canada jay looks like an exaggerated chickadee, and both birds are equally fond of bitter cold weather, but here the similarity stops short. Where the chickadee is friendly the jay is impudent and bold; hardly less of a villain than his blue relative when it comes to marauding other birds' nests and destroying their young. With all his vices, however, intemperance cannot be attributed to him; in spite of the name given him by Adirondack lumbermen and guides, 'Whisky John' is a purely innocent corruption of 'Wis-ka-tjon' as the Indians call this bird that haunts their camps and familiarly enters their wigwams. The numerous popular names by which the Canada jays are known are admirably accounted for by Mr. Hardy in a bulletin issued by the Smithsonian Institution:

"They will enter the tents, and often alight on the bow of a canoe, where the paddle at every stroke comes within eighteen inches of them. I know nothing which can be eaten that they will not take, and I had one steal all my candles, pulling them out endwise, one by one, from a piece of birch bark in which they were rolled, and another peck a large hole in a keg of castile soap. A duck, which I had picked and laid down for a few minutes, had the entire breast eaten out by one or more of these birds. I have seen one alight in the middle of my canoe and peck away at the carcass of a beaver I had skinned. They often spoil deer saddles by pecking into them near the kidneys. They do great damage to the trappers by stealing the bait from traps set for martens and minks and by eating trapped game. They will sit quietly and see you build a log trap and bait it, and then, almost before your back is turned, you hear their hateful ca-ca-ca as they glide down and peer into it. They will work steadily carrying off meat and hiding it. I have thrown out pieces and watched one to see how much he would carry off. He flew across a wide stream, and in a short time looked as bloody as a butcher from carrying large pieces; but his patience held

out longer than mine. I think one would work as long as Mark Twain's California jay did trying to fill a miner's cabin with acorns through a knothole in the roof. They are fond of the berries of the mountain-ash, and, in fact, few things come amiss; I believe they do not possess a single good quality except industry."

Very few oologists have been able to procure the eggs of this hardy bird, because they are laid in February or March when the snow is deep and travel through the forest is laborious. A few persevering collectors have successfully hunted the nests on snow-shoes. The three or four blue eggs, finely speckled with dark brown, are deposited in a large bulky nest made of stems, fur, feathers and moss, warmly lined and placed among the thickest branches, usually in a coniferous tree.

486. RAVEN. *Corvus corax sinuatus*. 22 to 26 in.

The Raven in appearance reminds one of an overgrown crow, though less gregarious, more shy, and more boreal. The raven has been observed near Lake Michigan about northern Illinois and Indiana during severest winters, and may be met with on both the Pacific and Atlantic coasts as well as in the interior.

The sub-species known as the northern raven undoubtedly reaches the coldest climates of any living creature. Arctic explorers in their search for the Pole have observed the raven where all other signs of animate life cease to exist. The plumage is in striking contrast to that of other boreal creatures, such as the ptarmigan, arctic fox, snowy owl and polar bear. Blacks being the warmest color, undoubtedly explains this bird's ability to reach such a northerly latitude.

Ravens may be frequently observed walking leisurely along the beaches just above the water line picking up the mollusks and other bits of marine life. Their note is a coarse croak, which seems to issue from the throat and is less musical than the call of the crow. In the northern countries of the Eastern Hemisphere, the raven is regarded

by some races as a bird of ill-omen. Ravens are readily taught to speak and are at times kept as pets.

Like the crow and jay, the raven is omnivorous, feeding on fish, grain, berries, and other forms of animal and vegetable life. Quite a few ravens breed in the mountains along the Pacific coast of California. The large nests of sticks are placed on little shelves in almost inaccessible places. They also breed along the rocky coasts of Maine, New Brunswick, Newfoundland and Nova Scotia.

The raven lays from two to five eggs; in shape and coloration they resemble the eggs of the crow, but like the bird are considerably larger.

488. CROW. *Corvus brachyrhynchos brachyrhynchos*.
19 in.

Crows range from northern Mexico to the Arctic regions, where they are then replaced by their larger relative, the northern raven. Crows which breed from northern United States northward usually migrate at the beginning of cold weather; in other localities, they are generally resident. The Florida, fish and northwestern crows inhabit the extreme portions of North America and are all closely allied to our common crow, the principal differences being in the size of the bill, feet and wings. A typical crow is entirely black with a metallic luster which is suggestive of purple or steel blue.

The female is slightly smaller than her mate. Crows adapt themselves to almost any diet; in fact, the bill of fare is as varied as are the call notes. Fruits, seeds, grain, insects, crawfish, carrion, eggs and young birds are all agreeable to a crow's palate; it is doubtful if he destroys enough insects to pay for his depredations.

Crows are intelligent birds, possessing calls so varied that naturalists have termed it a "Crow language." When taken young they may be taught to speak. They are cunning, mischievous, inquisitive and daring, so their reputation among other birds (also the farmer) is far from enviable. Although few are their friends and numerous their enemies, they have their virtues. Fond of corn and

especially sprouting corn, they are often shot for pulling it up, when they are really feeding upon worms. Crows are loyal to each other, and I know of no other bird (aside from the English sparrow) more capable of holding his own against all comers.

Less than seventy years ago the Indian, wolf, prairie chicken and wild-fowl, together with the crow, were the most prominent features of the Calumet region, in and about where Chicago is now located. With the encroachment of civilization, all have vanished save the crow, which continues to nest in considerable numbers within the city limits of Chicago. From October to April they congregate at dusk by the hundreds about some favorite roosting place, and at early morn they scatter about the country, apparently in search of adventure as well as of food.

The nesting season extends from March to June, according to locality. In the Great Lakes region eggs are deposited in April. Nests are placed from twenty-five to seventy feet above the ground, preferably in the crotch of a forest tree. In Dakota, where timber is scarce, during the latter part of May, 1900, I found them nesting only ten feet above the ground. Recently I have located about Chicago several nests which were only fifteen feet above the ground, while other pairs continue housekeeping at an elevation of sixty feet.

The bulky, substantial nests are constructed of twigs, hay, roots, grass and sod, with a lining of finer material consisting of bark strips and bunches of hair and wool. Last year's nests are a favorite receptacle for the eggs of the horned and barred owls, which utilize them for breeding purposes in February and March. The four to seven eggs so vary in size, shape and color, that eggs from the same nest frequently appear to have been laid by different birds.

Read 'Silver Spot, the Crow,' by Ernest Seton-Thompson.

491. CLARKE'S NUTCRACKER. *Nucifraga whymperi*.

Clarke's Nutcracker, or Clarke's Crow, is smaller than our true crows but larger than the jays. It is a shy, cautious bird inhabiting the mountainous regions of the United States and Canada. Comparatively little has been written about the habits of this bird owing to its shyness and retiring disposition. Naturalists find it difficult to visit the breeding grounds while the birds are laying their eggs or rearing their young.

Their food consists almost entirely of pine seeds, which they dexterously extract from cones, hence the range of the birds from year to year varies according to the abundance of pine cones. The female guards her eggs so closely that it is possible to remove the bird from her nest with the hand. Like the Canada jay and magpie, the nutcracker is possessed of great cunning, and is a restless, uneasy fellow.

In March and April when the snow is still deep on the mountain slopes, the nutcracker is constructing a warm nest in the densest part of some coniferous tree. In appearance the nest might readily be mistaken for that of a squirrel, being a substantial, warm structure in which the birds lay two to four eggs.

493. STARLING. *Sturnus vulgaris*. 8.5 in.

The original home of this bird is Europe. About two hundred varieties of the starling occur in various parts of Europe and Asia, but this introduced species is the only true starling to be found in America. The starling was originally given a place on the list of North American birds through record of a specimen from Greenland. Several unsuccessful attempts were made to introduce this bird into the United States before the last importation proved only too successful. About half a hundred birds were liberated in Central Park, New York, in 1890. They are now found resident from New Haven and Boston on the east to Philadelphia on the south and Albany on the north. So prolific are they that they increase in numbers

and extend the range almost as rapidly as did the English sparrow when first introduced. It is likely that a war of extermination will soon be declared.

Like our other foreigner, the English sparrow, these birds take refuge about the habitations of man, nesting in the crevices of buildings and hollow trees and lately in branches of trees. Outside of the breeding season they congregate in flocks about parks and orchards. Like our crow and meadowlark, the starling progresses on land by walking instead of hopping or running.

They are birds with handsome, glossy plumage and exhibit to a certain degree some of the intelligence and cunning possessed by our crows and jays. They are fond of mimicking other birds, and this trait can be cultivated to a remarkable degree by birds in captivity, for like some other members of the intelligent family they may be taught to speak.

In the Old World the starling, like the English sparrow, constructs a nest in the trees, under the eaves, in church steeples and in boxes erected for their accommodation. Outwardly the nests are constructed of twigs, straws and grasses, lined with finer material. The eggs are about the size of a meadowlark's and are pale blue unspotted.

15. STARLING FAMILY, CONT'D—BLACKBIRDS AND ORIOLES.

While birds of this family are usually tropical, some of our very interesting species belong to this group. Excepting the orioles, they are gregarious after nesting; some flock throughout the year, others during migration. They are found living in all kinds of territory, from marshes to the driest plains. They feed on fruit, seeds and insects; the males are often adorned with bright plumage. Some of these birds are noted for song, as the meadowlark and bobolink.

QUESTIONS.

When do you put out string for nest of orioles? What birds would appropriate this material if put out too early? Is one kind of material enough, or would you mix the material? Why? Why do orioles build hanging nests? Tell of reed bird and rice bird. Why are females of bobolinks and orioles of neutral color? Tell of economic value of meadowlark.

494. BOBOLINK. *Dolichonyx oryzivorus*. 7.3 in.

Most everybody knows the Bobolink, or Skunk Blackbird, so called because of the pattern of the male's plumage. Famous in prose and verse, he is the most popular songster of the starling family.

Bobolinks winter in South America, south of the Amazon. The plumage at that season of the year is light brown, the feathers being lighter on the margins, both sexes being dressed alike. In March the northward flight begins, and, when the birds reach Florida in April, the males have acquired the black and white plumage, and also their bubbling, rollicking song, so in keeping with the breezy meadows and flowering prairies. About May 1st, flocks of the males arrive in the central United States from New York west across the Mississippi valley. The females appear about a week later, when the game of hide and seek begins.

Bobolinks are abundant in certain localities from the central United States northward into southern Canada. In many a low pasture or weedy marsh, many swaying weed stalks contain a male bobolink. Suddenly a female, which always wears the same plumage used by both during the fall and winter months, arises from the ground where she has been deciding upon a suitable place in which to conceal her nest. Immediately from two to six males singing simultaneously pursue her in a zigzag course low over the waving vegetation. She drops to the ground but her pursuers continue in the air, flying in different directions before returning to their respective perches. Frequently while waiting for the object of their affection

to present herself, their ecstasy and passion seems uncontrollable and they launch into the air with outstretched wings and soar for perhaps thirty seconds in little circles, uttering their bubbling laughing song; then with upraised wings they gradually drop like a parachute to terra firma.

A bobolink is a true sport while nesting lasts. In July his ardor has cooled, for, before the month expires, molting has set in. He again assumes the dull plumage of the female and his only note is a metallic pink-pink.

After molting the birds gather in flocks and resort to rivers and marshes for the wild rice. Here they are slaughtered in great numbers as the popular game bird, the reed bird or rice bird. They feed upon both insect and vegetable material while nesting, and in the North are highly beneficial as they consume vast numbers of insects while nesting. Later in August and September rice is their principal food, and they are slaughtered in numbers in rice fields of the South.

No nest is harder to find, considering the abundance of the bird, than that of the bobolink. The nest is placed on the ground, usually in a little hollow flush with the surface. Sometimes the vegetation so cleverly conceals the nest, containing four to seven darkly spotted eggs, that one must carefully part the grass blades in order to see the hidden treasures. Many nests, however, are placed in open situations where the grass is short and scant. When you infer that the male is pouring forth his eloquence to vie with the neighboring bobolinks, he is really cautioning his mate and warning her of your presence; he sweeps about and at the psychological moment inserts into his music the bobolink signal. Madam gently arises from her nest and moves through the grass until she is probably fifty feet away before she ventures to expose herself, or in any way seems to recognize your presence. The nest may be in any direction from where you first discover the female, and neither parent is inclined to aid you in your difficult search. If the eggs are about to hatch or if the nestlings require the mother's warmth, she is loath to regard the warning notes of her mate and may

allow you to almost tread upon her before she flutters reluctantly away.

495. COWBIRD. *Molothrus ater ater*. 8 in.

Our common cowbird is found from the Atlantic west to the Plains; nesting from Texas to New Brunswick and Manitoba, wintering in southern Illinois south. It derives its name from the habit of feeding around cattle. Often several may be seen gathered about the feet of cattle and even alighting upon the backs of the animals, where they search for ticks and other parasitic insects. They also destroy great numbers of flies and other annoying pests about cattle, and also feed upon worms, grubs and other insect life which they are apt to obtain from nearby places, as plowed fields. They also consume a small amount of grain; but for their parasitic habits, they would be a most useful bird.

The head and throat of the male during the spring and summer months is cinnamon brown, the other parts of the plumage, a glossy black. The female is dull brownish without any luster to the plumage.

The call note of the cowbird is a sound not unlike the whistle of a woodcock's wing. These polygamous birds move about in groups of three to six, and the females seem to outnumber the males in the ratio of about two to one. The South Atlantic and Gulf States is the home of the dwarf cowbird, a distinct species but very similar in habits. West of the Mississippi and northward into Canada is the range of the red-eyed cowbird, which, unlike its near relative, lays a light blue unspotted egg.

Like the European cuckoo in one respect only, the cowbird, or cow blackbird, deposits her eggs in the nests of other birds, usually some smaller variety, as she builds no nest but leaves her eggs solely to the care of the foster parents. Nests of the yellow warbler, bobolink, indigo bunting, song sparrow, field sparrow, towhee, yellow-breasted chat, red-winged blackbird, and redstart are frequently used for this purpose. Sometimes the eggs of the cowbird closely resemble those of the owner of the

nest, as is true with the eggs of the towhee, chat and cardinal.

Such birds as the catbird, wood thrush and prairie horned lark resent such imposture and destroy or remove the cowbird's eggs. Some of the smaller species, as the yellow warbler, unable to cope with the situation, build over the intruder's eggs, since the cowbird often deposits her eggs before the owner of the nest begins to lay. I have known yellow warblers to repeat this operation three times in one nest in their effort to rid themselves of the unwelcome eggs. If hatched the intruders monopolize the nest, crowding the nestlings from their own cradle or starving and smothering them.

497. YELLOW-HEADED BLACKBIRD. *Xanthocephalus xanthocephalus*. 8.5 in.

Like the dickcissel, the occurrence of the Yellow-headed Blackbird is uncertain and erratic. In many sections from the Mississippi to the Pacific they may be found breeding singly or in small flocks, usually returning annually to the same swamps and marshes. East of the Mississippi their appearance is uncertain and rare. During years of study and observation in northern Illinois, I never discovered this bird spending the summer with us until 1900, when I observed a small colony nesting in a bayou on the south side of Chicago in company with redwings. The latter appeared to be in perfect plumage but the yellow-heads were a sorry looking lot, as the bright head, neck and throat had lost the luster. I finally concluded that the birds had soiled the plumage with soot by frequenting a patch of partially burned rushes.

The notes of the yellow-head are less vivacious than those of our other starlings, except the cowbird. The notes are uttered deep down in the throat and convey the impression that the birds are attempting a sarcastic laugh at the expense of their vivacious associates, the red-winged blackbirds. These birds are also frequently found in company with the cowbird around cattle, except

at nesting time. In habits and food they are similar to the redwing, making the bird a friend to agriculture.

During the last five years the yellow-heads have colonized in several places near Chicago, and appear to increase in numbers annually. They invariably nest in bulrushes or cattails over water. Externally the nests are composed of strips of bulrushes; sometimes wild rice and other reeds are used in the composition with a lining of the same material but finer. Three to five eggs are deposited about the middle of May. The background is pale bluish white so thickly covered with specks and spots of light brown that we imagine we have found a nest of brown eggs, when we first stand up in the boat and peer over the edge of the nest.

498. RED-WINGED BLACKBIRD. *Agelaius phoeniceus phoeniceus*. 9.3 in.

The Red-winged Blackbird, or Red-shouldered Blackbird or Red-winged Starling, inhabits the United States and southern Canada, west to the Plains. Abundant where marshes and lakes are common, of late years several divisions have been made in the geographical distribution of this species, and as a result several sub-species have appeared on our bird list, though the habits and general appearance is the same in all. The males have a scarlet patch on the bend of the wing and the females, while not possessing any of the bright effects, are also handsome birds, as streaks of black, grayish and white run lengthwise on the under parts of the female, giving her a pleasing appearance.

The call, "Konk-la-ree," the last syllable having a drawn-out effect, is the song of the redwing and, though his attempt at singing is really a failure, the notes are well in keeping with the dismal swamps and marshes frequented. His haunts are the retreats of many other birds, but he is the only red-plumaged bird among them. Both sexes produce the mellow "chink" characteristic of blackbirds in general. It may be heard in August and September when great flocks of the redwings descend

upon the grain fields and wild rice. At that season they are frequently served on the bill of fare as reed birds, which name supposedly refers to the bobolink only.

Before the snow disappears from the shady fence corners and thin ice still forms after sunset, the redwing returns and we welcome the notes "konk-la-ree," which we hear from a distant willow just as the ducks are settling in the bay for their evening repast.

Redwings subsist on seeds, including grain, fruits and insects. While breeding they destroy great numbers of insects, while their fondness for grain is manifested when they congregate in the late summer months and stop in the cultivated fields on their southward journey.

Farmers' Bulletin, No. 54, states that little grain is consumed by these birds, while about 57 per cent of their fare is injurious weed seeds. It eats but little fruit and altogether it is estimated that seven-eighths of its food is injurious weed seeds and insects, indicating that the bird should be protected.

Redwings are very jealous of their eggs and young and attack without hesitancy all hawks, crows or other marauders with almost as much aggressiveness as does the kingbird.

The nests are placed in low bushes on or near the water. Many times the nests are woven to the upright stalks of cattails or bulrushes. Dry grass, stems and strips of rushes are used externally and the inside is lined with fine stems. Some nests have Indian hemp on the outside, giving them the appearance of a large, yellow warbler's nest. The four or five eggs are light blue marked with scrawls and streaks of deep purple and black, chiefly about the large end.

501. MEADOWLARK. *Sturnella magna magna*. 10.8 in.

All United States and southern Canada is favored with the presence of the meadowlark, sometimes wrongly called field-ark. Florida, Georgia, and Alabama are inhabited by the southern meadowlark. From Iowa and Minnesota westward across the continent in the United

States and Canada, the western meadowlark, a more musical variety, ranges. Southwestern Texas along the Rio Grande, east to Louisiana, is the home of the Mexican or Rio Grande meadowlark. The true meadowlark occurs from New York, New England and Quebec, west to the states bordering the Mississippi on the west. In portions of Iowa and Missouri, both the western and eastern meadowlark may be found breeding together.

Before there is the slightest indication of budding life, except in the reddening of the willow stems, this robust little fellow returns from the South to his favorite meadow or pasture. No bird becomes more attached to a given locality than this starling. He weathers many a cold northwester, eking out an existence on weed seeds and a little grain. Old tussocks of grass or a weather-beaten corn-shock offers protection from the frosty nights, which are still due for five or six weeks.

The flight is low and he moves in a horizontal line, alternately flapping and sailing much like the bob-white, the field-mark being the two white outer tail feathers. His mode of travel through the air would suggest that his flight was uncertain and that he had not fully developed or mastered the art of aviation.

What can be more cheerful than the whistle of this lark? The song flight is a more pronounced demonstration of affection and is probably for the benefit of his mate, which may be the pursued or *vice versa*.

I quote the following from F. E. L. Beal's report in Farmers' Bulletin, No. 54: "In 285 stomachs examined, animal food (practically all insects) constituted 73% of the contents, and the vegetable matter 27%. As would naturally be supposed the insects were ground species, such as bugs, beetles, grasshoppers and caterpillars, together with a few flies, wasps and spiders. A number of stomachs were taken from birds killed when the ground was covered with snow, but even these contained a large percentage of insects, showing the bird's skill in finding proper food under adverse circumstances." Grasshoppers seem to be the natural food.

More than half of the meadowlark's food consists of harmful insects. Its vegetable food is composed either of obnoxious weeds or waste grain. The strong point in the bird's favor is that, although naturally an insect eater, it is able to subsist on vegetable food and consequently is not forced to migrate in cold weather farther than is necessary to find the ground free from snow. It should never be regarded as a game bird, nor is it right that these useful birds be protected in the North only to furnish Southern pot-pies.

So closely do these birds guard the contents of their nests that the farmer's mower frequently passes over the hidden treasures without fatal results to the close-sitting parent. They gather in migrating flocks in fall.

506. ORCHARD ORIOLE. *Icterus spurius*. 7 in.

The Orchard Oriole ranges throughout eastern North America, from the Gulf to Canada, wintering in Central America.

The orchard oriole was until fifteen years ago one of the characteristic birds of the Chicago area, and he appeared the embodiment of this hustling center, as he is apparently always in a hurry. Even his notes though pleasing are uttered while he is rapidly moving through the foliage removing caterpillars from the leaves or other forms of insect life from the bark of trees. It, like the Baltimore oriole, is welcome about the home as the beauty, the song and the destruction of insect life makes it a highly useful bird.

The plumage of the male orchard oriole is darker than that of our other American orioles and should not be mistaken for the more common Baltimore. With the Baltimore oriole this is the only species common to eastern North America. Orioles are not forest-loving birds, but seem to prefer orchards, shade trees or a narrow growth of trees along streams.

Unlike the Baltimore, the orchard oriole uses grass almost exclusively in constructing a nest. The grass consists of long blades obtained while green. After the

nest is completed the grass becomes cured into a beautiful yellowish green. The shape of the nest and the attachment to the small twigs remind one of the nests built by our vireos, but is somewhat larger and built of different material.

Frequently the orchard oriole has the peculiar habit of constructing two adjacent nests. Four to six eggs are laid; the background is bluish gray and the markings appear in the form of dots, irregular blotches of dark brown and black. They bear a general resemblance to the eggs of the red-winged blackbird, being without the serawls or pen lines so frequently seen on the eggs of the Baltimore oriole.

507. BALTIMORE ORIOLE. *Icterus galbula*. 7.5 in.

The "Fire Bird," "Hang Nest" or "Troupalo," is named in honor of Lord Baltimore who wore the black and orange robe. In the eastern United States this is the most striking of the starling family. It breeds from the Gulf to Canada, wintering in Mexico and Central America. The orioles live principally on worms and their larvæ. They are among our most valuable birds, and should be encouraged to nest about yards and orchards by putting out nesting material.

The notes of the male oriole are more musical than those of the various blackbirds, and are perhaps slightly suggestive of the whistle of the meadowlark though less clear and uttered more hastily. The call or alarm note used by both sexes is a low rattle suggestive of the kingfisher's note.

Their nests are placed at the extremities of drooping branches, preferably those of the elm, maple and locust, being wonderful examples of bird architecture. The material used in construction varies greatly with the bird's locality, but is largely of uniform material so as to weave the better. Some nests are constructed almost exclusively of horse hair; others are made of grayish white plant down known as Indian hemp, or of string and ravelings. The inside of the nest is of finer material and the whole struc-

ture is so fastened to the limbs or branches that it swings in the breeze usually independent of the limbs to which it is attached. The mother bird lays her eggs and hatches in a cradle her young where they may be lulled to sleep by the warm winds of May and June.

The four to six eggs have a white background and are remarkably colored with scrawls or pen lines of dark brown or black resembling Chinese writing.

Year after year the birds return to the same tree to nest. Roadsides, orchards or a large shade tree close by the water's edge are favorite sites.

508. BULLOCK'S ORIOLE. *Icterus bullocki*. 7 in.

This handsome bird is probably the commonest of the western orioles. In size and shape it resembles our eastern variety, the Baltimore oriole. Inhabiting the territory west of the Great Plains to the Pacific Ocean, it is common in both flat and mountainous sections. While taking a few berries to mix with the insect diet, like the orioles found in eastern North America, it is highly beneficial because of insect diet gleaned from foliage and bark of trees. The call note is rather melancholy, a whistle and warble combined.

The nests, like those of the Baltimore oriole, are pensile and attached to the smaller branches of limbs at an elevation ranging from ten to thirty feet. The nests are constructed of various kinds of material, usually the most available is utilized. This may be string, plant fiber, horse hair or grass. The inside of the nest is lined with finer substances. The nests, while securely attached to the limbs and stems, frequently swing independently of the branch to which they are attached.

Four to five eggs are laid usually in May. The background is pale bluish white and the markings appear in the form of scrawls and pen lines of deep purple and black.

509. RUSTY BLACKBIRD. *Euphagus carolinus*. 8.5 in.

The Rusty Blackbird, or Grackle, is about the size of our common red-winged blackbird. These hardy birds

frequently spend the winter in southern Illinois and Indiana. The feathers are edged with brown and this appearance has caused many observers to describe this bird as the thrush blackbird. These birds do not congregate in immense droves like some of our starling family, but usually appear in the Great Lakes region semiannually in small flocks, in spring singing the musical medleys. They are often mistaken for female redwings; and sometimes mistaken for grackles, though the smaller size and duller plumage readily distinguish them from the grackles.

The bird lives practically upon insects, except during the migrations, when a moderate amount of grain and small wild fruit is consumed. It is therefore useful and should be protected. Brewer's blackbird, a species similar to the rusty blackbird, is found breeding in the western portions of the United States from the Rocky Mountains to the Pacific.

Nova Scotia, New Brunswick, Newfoundland and Labrador are favorite nesting grounds. The nests are composed of stems, grass and moss mixed with mud and usually placed in coniferous trees similar to the abode of the purple and bronzed grackles. The eggs are light blue distinctly marked with blotches and spots of dark brown and purple.

511b. BRONZED GRACKLE. *Quiscalus quiscalus*
æneus. 13 in.

The Bronzed Grackle, or the "Crow Blackbird," or one or more of its sub-species, is a familiar object in all the states east of the Rocky Mountains. In size, habits, etc., this bird is so much like the purple grackle that one plate does for both. Throughout the year it is resident as far north as southern Illinois, and in summer extends its range into the British provinces. In the Mississippi valley it is one of the most abundant birds, preferring to nest in the artificial groves and windbreaks near farms instead of in the natural "timber" which it formerly used. It breeds also in parks and near buildings, often in considerable colonies. In New England, it is only locally

abundant though frequently seen in migration. After July it becomes very rare, or entirely disappears, owing to the fact that it collects in large flocks and retires to some quiet place where food is abundant and where it can remain undisturbed during the molting season; but in the latter days of August and throughout September it usually reappears in immense flocks before moving southward.

"The crow blackbird is accused of many sins, such as stealing grain and fruit and robbing the nests of other birds, but the farmers do not undertake a war of extermination against it, and for the most part allow it to nest undisturbed about their premises. An examination of 2,346 stomachs shows that nearly one-third of its food consists of insects, of which the greater part are injurious. The bird also eats a few snails, crawfishes, salamanders, small fish, and occasionally a mouse. The stomach contents do not indicate that it robs other birds to any great extent, as remains of birds and birds' eggs amount to less than half of one per cent.

"It is on account of its vegetable food that the grackle is most likely to be accused of doing damage. Grain is eaten during the whole year, and during only a short time in summer is other food attractive enough to induce the bird to alter its diet. The grain taken in the winter and spring months probably consists of waste kernels gathered from the stubble. The stomachs do not indicate that the bird pulls sprouting grain; but the wheat eaten in July and August and the corn eaten in the fall are probably taken from fields of standing grain. The total grain consumed during the year constitutes 45 per cent of the whole food, but it is safe to say that at least half is waste grain, and consequently of no value. Although the crow blackbird eats in their season a few cherries and blackberries, and in the fall some wild fruit, it apparently does little damage in this way.

"Large flocks of grackles no doubt do considerable injury to grain crops; and there seems to be no remedy except the destruction of the birds, which is in itself ex-

pensive. During the breeding season, however, the species do much good by eating insects and by feeding them to its young, which are reared almost entirely upon this food. The bird does the greatest amount of good in spring, when it follows the plow in search of large grubs, of which it is so fond that it sometimes literally crams its stomach full of them." (Farmers' Bulletin, No. 54.)

The bronzed grackle is the western form of the purple grackle, commonly known as the crow blackbird. These birds are very sociable and frequently nest in colonies. Until recent years, the bronzed grackle exhibited a decided preference for coniferous trees, and the scarcity of these birds in Chicago was probably due to the fact that few places afforded suitable nesting sites. Outside our cemeteries, evergreen trees were uncommon. Since 1904 the bronzed blackbird has become abundant in northern Illinois, nesting in the public parks and shade trees. This bird is not legally protected in many of our states, owing to the great ravages they make upon the grain fields and berry crops. Their notes are hoarse and unmusical; the flight slow and laborious.

The nest is a bulky affair of dried grass, stems and roots, lined with light grass and placed usually in a coniferous tree. The three to six eggs are light blue, marked and scrawled with irregular shades of brownish black.

16. FINCHES—SPARROWS.

The family, *Fringilladæ*, includes sparrows, various finches, crossbills, dickcissels, etc. This is the largest family of birds and contains some of our most sociable species. Most birds of the family feed on the ground. The beak is strong as most birds of family feed on seeds. Some are migratory while many of them are resident throughout the year. Many of them are noted songsters. They vary in plumage from the beautiful cardinal to the

dull-colored sparrow; the bright colored grosbeaks and finches are usually arboreal.

QUESTIONS.

Are the birds of this group generally beneficial to man? Why are the arboreal forms highly colored? Why are the beaks so strong? Which is your favorite of the group? Are any of these birds game birds? Why? Tell what you can about our introduction of English sparrows into this country. Why have they increased so rapidly? What has been the effect on our native birds? How does the sparrow sometimes outwit the robin? Where do English sparrows build? Why close door of martin boxes in fall and reopen on their return in spring? Why make opening to wren's box only large enough to admit it? Account for color of snow bunting. Of sparrow. Account for freak beak of crossbill. How can you tell the goldfinch after molting? Why does it sing so late in year? How is nest lined? Why are the longspurs so called? What is field-mark of junco? Of vesper sparrow? What other birds have tail feathers similar? Account for abundance of song sparrow. What names are applied to cardinal? Give three reasons why cardinal and rose-breasted grosbeaks are desirable. Why are so many of our resident birds of finch family? Where are the English sparrows first found, in city or country? Do sparrows feed the young on insects or seeds? What of their relation to canker-worm? Account for names of some birds of the group, as rose-breasted grosbeak, potato-bug bird. Why do dickcissels migrate while crossbills drift about in winter?

540. VESPER SPARROW. *Poæceles gramineus gramineus*. 6 in.

The true form of the Vesper Sparrow, Bay-winged Bunting or Grass Finch, ranges from the Plains eastward across the United States to southern Canada. The territory known as the Great Plains northward into Canada is inhabited by a sub-species known as the western vesper sparrow. In the northwest through Oregon, Washing-

ton and portions of the Canadian provinces, another species called the Oregon vesper sparrow occurs.

Like the junco, the vesper sparrow may be recognized by the white outer tail feathers. It spends most of the time on the ground, rising to fence posts and low trees to sing the evening carol. I have often thought that the song of the vesper sparrow is sweeter than that of any other sparrow. It may be heard long after sunset coming across the fields when the little screech owl and the whip-poor-will are calling. Pastures, orchards, grain fields, and the right-of-way along railroads are frequented by the grass finch. It feeds almost exclusively on weed seeds and is consequently beneficial to agriculture.

The nest of grass, stems and rootlets, lined with grass and hair is placed on the ground. A little hollow is scraped at the base of a thistle, mullein, other weed stalk or hill of corn. The female sits close and offers little protest when disturbed. The four bluish white eggs are blotched and spotted with reddish brown. Two broods are reared in a season.

542a. SAVANNAH SPARROW. *Passerculus sandwichensis sandwichensis*. 5.7 in.

The Savannah Sparrow is about the size of the grasshopper or yellow-winged sparrow and may be mistaken for the vesper sparrow. These birds inhabit eastern North America, breeding from the Ohio River northward to Labrador and Hudson Bay. They are inconspicuous birds and like the yellow-wing, Henslow's and Leconte's sparrows retire to grassy tracts where they move about by running over the ground, for like the rails they use their wings only when closely pressed by their enemies. In the New England states the savannah sparrow is quite abundant, being found nearly the entire year. Like other terrestrial sparrows it is usually called ground sparrow.

The savannah sparrow subsists largely on the seeds of weeds and grasses, but the young are fed upon insects, as the nestlings of all the finch family seem to thrive best on an insect diet. As every farmer knows, the cost of

farming is largely augmented by the expense of fighting weeds, the seeds of which are capable of germinating after being buried in the soil for even years. Sparrows destroy myriads of these seeds.

The nests are slight hollows in the earth lined with fine grass. Four or five eggs are laid during the latter part of May or early June. They possess a light greenish background with purple and dark red spots, appearing chiefly on the larger half of the egg.

547. HENSLOW'S SPARROW. 5 in.

This retiring little bird, common on the prairies and grassy fields of Ohio, Indiana, Illinois, Michigan and Wisconsin, is slightly smaller than the grasshopper sparrow with a note less extensive. The birds usually sing from a weed stalk but rather inconspicuously, and much of their time is spent upon the ground where they run through the grass like a rail. Owing to their secretive habits they are commonly overlooked.

552. LARK SPARROW. *Chonclestes grammacus grammacus*. 6.3 in.

The Lark Sparrows are found in the central portions of the United States from Dakota, Nebraska and Kansas, eastward to Michigan and Illinois. They breed from Texas, northward into Wisconsin, North Dakota and casually east to New York and New England. They migrate south in winter to Florida and the Gulf States.

The lark hunting is one of the finest songsters among our native sparrows. Twenty years ago they were a common summer resident about northern Illinois, but of late years they have become rare. The sub-species described as the western lark sparrow, occurring west of the Mississippi, appears to be more abundant than the eastern form.

Mr. Ridgway describes the song as being composed of a series of chants, each syllable rich, loud and clear, interspersed with emotional trills.

These birds nest in May and June. The nests are

built on the ground in weedy fields or neglected pastures. One of their favorite nesting spots when the birds were common about Chicago, was the right-of-way between the railroad bed and the fence enclosing the tracks.

Mr. E. R. Ford, one of Chicago's advanced bird students, presented me with a nest of four eggs taken May 31, 1891, along the railroad track in what is now the subdivision of Argyle Park, Chicago. The nest was composed of wood fiber, rootlets and grass, lined with horse hair. The four eggs have a white background and are beautifully marked with black scrawls and lines, suggestive of the eggs of the Baltimore oriole or red-winged black-bird.

554. WHITE-CROWNED SPARROW. *Zonotrichia leucophrys leucophrys*. 6.8 in.

Probably the handsomest of our American sparrows, they range from the Atlantic to the Rocky Mountains, spending the winter many miles south of their breeding grounds. The birds rarely nest in the United States except in Alpine regions of the Sierra Nevadas and the Rocky Mountains. They generally resort to the moist sections of Labrador, Newfoundland and west across the northern portions of Quebec, Ontario and Manitoba. They winter throughout the United States south to Mexico. The bird reminds one of the white-throated sparrow, or peabody bird, but the white-crowned sparrow has no white on the under parts. It is less common than the white-throated sparrow and moves northward usually in May, sometimes lingering in the Great Lakes region until June 1st.

Ernest E. Thompson describes the song as resembling that of the white-throated with a peculiarly sad cadence, and in a clear soft whistle that is characteristic of the group. Another peculiarity of this species is its habit of singing some of its sweetest refrains during the darkest hours of night.

The bird is of great economic value, subsisting during its migrations almost exclusively on the seeds of various weeds, obtained in the fence corners, along hedges and

about gardens. The young when first hatched are fed upon insects.

558. WHITE-THROATED SPARROW. 6.7 in.

This happy bird is a common migrant through the United States up to northern Minnesota, Wisconsin, Michigan, and the Green Mountain region where it appears in company with the slate-colored junco. The song is a sweet whistle which may be described by the word "Peabody," repeated five or six times. In fact, the bird is known as the peabody bird in many localities. They are about the size of the white-crowned sparrow for which they are often mistaken, but are more numerous. One plate will answer for both birds.

559. TREE SPARROW. *Spizella monticola monticola*. 6.4 in.

Many cold winter days when the snow lies in drifts along the hedges have I found the little tree sparrow the only evidence of bird life. Of the size of our common chipping sparrow, it is readily distinguishable by a small black spot in the center of the breast.

Tree sparrows breed in the far north along the ice-bound coast of Labrador and beyond. They are with us in the Great Lakes region from November until late March, a sociable little fellow usually traveling in flocks. They have a faint call note, a mere chirp, but their song, which is often poured forth while the days are short and cold, is a very pleasing little ditty.

Probably no other sparrow is more beneficial. In every waste spot where the sod has been disturbed, unless kept down, rank weeds spring up and often form dense thickets. These fields afford food and shelter for many winter birds, enabling them to withstand the cold and the snow. Visiting one of these growths on a cold January morning, one is surprised at the animation of the busy little tree sparrows as they move rapidly about devouring on an average each one-quarter ounce of noxious seeds per day.

The eggs of the tree sparrow are pea-green spotted and speckled with reddish brown. Three to five eggs are laid in the warm little nest constructed of grass, rootlets and hair. The nests are placed in mossy situations on the ground or in a little shrub at a low elevation.

The western tree sparrow, very similar in plumage and habits, is the form occurring from the Great Plains northward to Great Slave Lake and even to Alaska.

560. CHIPPING SPARROW. *Spizella passerina passerina*. 5.7 in.

The Chipping Sparrow ranges throughout eastern North America; breeding from the Gulf to Newfoundland and Great Slave Lake; wintering in the Gulf States and Mexico.

The "Chippy" is the dooryard sparrow or was until the unwelcome English sparrow put in an appearance. The monotonous little trill may be heard about our porches, in the vines, lilac bushes and hedges. Fond of little coniferous trees, three or four pair often spend the summer about a single farmhouse.

The nests are composed almost entirely of horse hair with outer covering of rootlets. By some the little fellow is known as the hair bird. These nests are usually placed in a little cluster of branches not to exceed twenty feet above the ground, often as low as four feet. Orchard trees are favorite nesting sites, and the birds also are to be found in the berry patches occupied by the indigo bunting and field sparrow. Some years ago I had the unusual experience of finding four nests of the chipping sparrow within a radius of 150 yards, all of which were placed on the ground, an unusual occurrence, especially as three of the nests were practically in the shade of orchard trees.

Four blue eggs dotted at the larger end with black are laid in May. A second brood is often reared in July.

563. FIELD SPARROW. *Spizella pusilla pusilla*. 5.7 in.

The range of the Field Sparrow is eastern North America, breeding from North Carolina to Quebec and Mani-

toba and wintering from southern Illinois and Virginia southward.

In appearance this bird reminds us of the chipping sparrow, but is slightly smaller. Gardens, brushy pastures and second growth timber are favorite resorts of this bird, which is very common east of the Plains in temperate North America. Their song like that of the indigo bunting and dickcissel is not uttered at any particular time of day, but we are apt to hear the little fellow singing when the sun is shining the hottest. The rather weird notes are in the form of a prolonged musical trill, though subject to great individual variation.

Though comparatively unsuspicious the field sparrow is not so familiar about the haunts of man as some other varieties. It prefers a little patch of berry bushes or growth of haw where the grass and weeds are long and thick.

The nests are often placed in tussocks of grass at the base of a bush or among the twigs of a shrub at low elevations. Long fine grass is used in constructing the nest. The lining may consist largely of horse hair. The background of the three or four eggs is pale bluish green, and the markings are in the form of reddish spots, chiefly at the larger end. Two broods are often reared in a season. In the Great Lakes region, these birds arrive from the south about the middle of April and depart in October, though their song is not often heard after the middle of July.

581. SONG SPARROW. *Melospiza melodia melodia*.
6.3 in.

The range of the Song Sparrow is eastern North America, breeding from northern Illinois north to Hudson Bay; wintering from Illinois and New York to the Gulf.

Ernest E. Thompson says: "The song sparrow's vast range in a dozen varying climates, its readiness to adapt itself to the different conditions in each of the regions it inhabits, its numerical abundance and steady increase

while some of its family are dying out, its freedom from disease and vermin and its perennial good spirits, evidenced by its never-failing music—all proclaim that it is indeed one of nature's successes.

"Its irrepressible vivacity and good spirits in spite of all circumstances are aptly illustrated by the fact that its song may be heard every month of the year and in all weathers; also by night as well as by day—for nothing is more common in the darkest nights than to hear its sweet chant in self-conscious answer to the hooting of the owl or even the report of a gun.

"It is never seen far from the water. Its alarm note is a simple metallic 'chip' which is very distinctive. But its merry chant—which has won for it the name of 'song sparrow'—is its best-known note. It is a voluble and uninterrupted but short refrain, and is perhaps the sweetest of the familiar voices of the meadow-lands. The song that it occasionally utters while on the wing is of quite a different character, being more prolonged and varied. Though so abundant it cannot be called a sociable species. Even during the migrations it is never seen in compact flocks."

We should not infer from this bird's name that he is any more of a musician than the other varieties; in fact, he by no means ranks first as a songster in his class.

Probably no other bird has been dissected as much as this species. At last accounts the ornithologists in compiling their check list of North American birds decided that this little fellow varied sufficiently in minute feather markings to justify dividing him into about a dozen and a half different forms. We have, as a result, the song sparrow proper, inhabiting the region east of the Mississippi River to the states bordering the Atlantic; other forms are called the Dakota song sparrow, Samuel's song sparrow, mountain, San Diego, Alameda, rusty, sooty, desert, etc., etc. The difference, however, is not perceptible except when the exact locality is taken into consideration, and it requires a microscopic examination to separate them at last.

There is one species, however, which resembles this form but is entitled to be classed separately. That is the Aleutian song sparrow, a larger and darker plumaged bird found only on the Aleutian Islands off the Alaskan coast. Owing to the influence of the Japan current the climate on the Islands is comparatively mild and the bird is a resident there the year round. Our song sparrows in the Great Lakes region would probably never migrate were it not for the scarcity of food during the winter months when the ground is apt to be covered with snow and ice.

The song sparrow is partial to willow growths and no matter how early the willow stems brighten and the catkins fill, this species is hopping among their branches just before the sap of the hardy shrub is flowing upward.

Perhaps he is called song sparrow because he sings from more conspicuous places than many of our other sparrows. Perched on a naked twig or on a fence post, often within a stone's throw of our dwelling, he pours forth a short song which is a liquid chirp and trill.

The nests are often placed on the ground along little streams or in damp places. I have also found many nests in hedges, and one or two among the crevices of decayed wood in an old stump. They seldom nest in trees unless they contain a cluster of low branches enabling the bird to construct her nest within four or five feet of the ground. Grass stems, hay and horse hair are the principal materials used. The nests are bulky but well cupped. Both birds assist in nest building. They utter a saucy little chirp when disturbed. The four or five eggs vary greatly in markings. The background may be white, bluish white or light green; the spots are red, dark brown or lilac, often clustered and sometimes wreathed about the larger end.

Three broods are often raised in a season. The first nests are ready for occupancy by the last week in April, another set of eggs are laid about June 1st, and again in August we may expect to find the mother incubating.

This bird may be distinguished from many of our other resident sparrows by the heavily spotted breast and the dark brown feathers above.

585. FOX SPARROW. *Passerella iliaca iliaca*. 7.3 in.

The Fox Sparrow, the largest of our true sparrows, breeds in Canada and winters from Virginia southward. It is found in the Great Lakes region during March and April, and we have it again in October, but it is less conspicuous in the fall. The birds are in full song during their spring migration and their joyous notes are very sweet and liquid. While a few of them stop in Newfoundland, most of them summer in Labrador and beyond to Hudson Bay. In spring the fox sparrow is found around thickets and woodsides, often with juncos; in fall it is usually seen along hedges and in weedy grain fields near shrubbery, scratching like a hen. Brush piles and thickets around swampy places are other favorite haunts while passing through the United States.

They are very sociable birds and we regret their preference for the more northerly latitudes, where little opportunity has been afforded the bird lover to effect a personal acquaintance during the mating and nesting season.

The nests are placed on the ground securely imbedded in the moss found under the drooping branches of coniferous trees.

248. LECONTE'S SPARROW. 5 in.

This daintily marked little bird was known to Illinois ornithologists only as a migrant where it occurred in given localities during the months of September and October. In 1910 the writer found them breeding in Cook County, Illinois, among a dense growth of grass and weeds bordering a prairie marsh.

17. FINCHES—FAMOUS FOR BEAUTY.

514. EVENING GROSBEAK. *Hesperiphona vespertina vespertina*. 8 in.

The Evening Grosbeak is a rather heavy set bird with large head and powerful beak. This form occurs from Maine, New Brunswick and Labrador west to Manitoba

and Alaska; south in winter to northern United States. The western evening grosbeak is a species of lighter coloration and occurs in the Rocky Mountains and Sierra Nevadas. Grosbeaks winter in Alpine regions bordering on the plains and in Canada south to northern United States into New York, Ohio and Illinois at irregular intervals from October to May.

Evening grosbeaks are very sociable fellows, often associating with pine finches, crossbills and waxwings. They thrive on buds and winter berries. During the coldest days of January these hardy birds may be seen moving in flocks of from say six to sixty from limb to limb, calling to each other in their mild subdued notes, "chee, chee, chee." By no means shy birds, they are found in our public parks and highways perfectly unconcerned.

I have a nest and three eggs taken June 11, 1909, on the mountains in Arizona at an altitude of 7,000 feet. The nest was placed 55 feet up in a pine tree and on a limb 20 feet from the trunk. The nest is made of dead pine twigs lined with fine grass and rootlets.

524. GRAY-CROWNED ROSY FINCH. *Leucosticte tephrocotis tephrocotis*. 5.5 in.

By a recent committee of the American Ornithologists' Union this bird was given the name of Gray-crowned Rosy Finch instead of gray-crowned leucosticte. In the United States and Canada we have several varieties of the leucosticte but they are chiefly confined to the western portions of the continent. Members of the Alpine regions like the ouzels and longspurs, they are sociable little fellows. Their choice of territory for breeding purposes is in keeping with those of the evening grosbeak and white-tailed ptarmigan in nesting in the far north or in the highest mountains. The birds spend most of their time upon the ground collecting their food of seeds and insects.

Little has been written regarding the rosy finch and its near allies, chiefly because their summer range takes them to the more inaccessible mountain regions where collecting is difficult, unless a small number of naturalists organize an expedition for that purpose.

The nest of the leucosticte, constructed almost entirely of grass, is placed in crevices of the rocks, under boulders, or on little ridges at altitudes above timber line. Like the eggs of swifts, owls, petrels, and other birds which nest in dark places or in crevices, they are white unspotted.

529. GOLDFINCH. *Astragalinus tristis tristis*. 5.1 in.

The names Goldfinch and Wild Canary are applied indiscriminately by the casual observer to a score of different birds when some yellow warbler chances in the path of an inexperienced but enthusiastic bird admirer.

In the United States our true goldfinch, or wild canary, remains with us throughout the year and is known in various phases of plumage according to the season. The flight and flight note betray these birds after the fall molting when they have left off the bright colors.

The charming ways of a devoted pair of these hardy creatures should render them easy of identification at all times. Few farm orchards or thistle patches are without a pair of these little birds. The male, with a voice equal in tone and quality to his beautiful plumage of black and yellow, finds a warm place in the heart of the bird-lover, naturalist, and agriculturist. The mating song is especially noticeable, coming so late in the year. These are not the only virtues possessed by the goldfinch, as he is of great economic value, because of the destruction of seeds of the thistle, the dandelion, and other noxious plants.

The female is less vivacious than her mate, but she has that small sweet call note so full of expression. Their voices have always impressed me as having something human about them. Goldfinches are fond of each other's society and are usually found in flocks except when nesting. Their flight is conducted in a peculiar undulatory manner, as both sexes dart back and forth above the tree tops whose dense foliage shelters many a nest of treasures. Twittering incessantly while on the wing, their life appears one perpetual round of happiness. Their mating song is beautiful and is striking, as it is heard after most other song birds are silent for the year.

In July or August when thistle-down is floating in the air, the female usually selects for a nesting site the crotch of a fruit or shade tree, often close to dwellings. Indian hemp, vegetable-down, and plant fibers are securely woven and matted together forming a substantial, broad-brimmed, deeply hollowed nest into which a bountiful supply of thistle down is placed. The nest is usually situated within twenty feet of the ground. They often nest on the tops of thistles, from which habit and because of fondness for seeds and down they often take the name thistle bird. Three to six faint bluish white eggs are laid. The period of incubation is two weeks.

The nest of the goldfinch found on chart 25 was built in an oak shrub, five feet from the ground, and was taken September 1, 1901. At this late date incubation had only commenced, and, although the timber about the nesting site swarmed with migrants passing southward, Mother Goldfinch expressed no anxiety over the late condition of her household affairs.

593. CARDINAL. *Cardinalis cardinalis cardinalis*. 8.2 in.

The Cardinal, our true "Red Bird," is found in some form or phase of plumage from the Atlantic to the Pacific. It ranges south of the Great Lakes in the eastern and central states. Resident wherever found, he is generally working his way northward, selecting river courses in reaching the regions about northern Illinois and Indiana. The males are handsome birds with dark red plumage; the females, although possessing the handsome crest carried by all cardinals, is much paler in plumage, having ashy brown feathers similar to those worn by the scarlet tanager, indigo bunting, bobolink, and other female birds whose mates are conspicuously colored.

Cardinals are common inhabitants of the river bottoms about St. Louis and at points along the Illinois River one hundred miles below Chicago. During the winter months often two to six or more pairs will be found frequenting a small thicket. Despite the fact that they

are able to withstand cold weather, very few of them are found as far north as the Great Lakes region.

Their powerful bills enable them to crack the seeds and dissect fruits that other birds are unable to examine. They are birds of great economic as well as of poetic value. A small quantity of grain scattered about the dooryard in winter will readily attract these handsome birds and cause them to become permanent residents of a given locality in limits of their range. The males have during breeding time a dozen distinct notes and they may be heard whistling twelve months in the year. As one writer says, "The notes of the cardinals are clear and tender—far sweeter than the mellowest notes of fife or clarionet." Red-birds are easily captured and make admirable cage birds. Until our song-bird law went into effect cardinals were handled extensively by various song-bird dealers.

The nests are built in shrubs, vines, and young trees about residences in small towns and villages. The nests are of twigs, bark, grass and leaves lined with finer substances of the same. Three or four bluish white eggs heavily spotted with dark brown and lavender are laid. The nests are usually not to exceed ten feet above the ground. The birds enjoy a thicket or dense growth of shrubbery similar to that inhabited by our catbird or brown thrasher. They raise two broods in a season, the male caring for the first brood while the female attends to nesting duties. They sometimes select for nesting sites shrubbery about porticoes, seemingly to avoid the blue jays.

587. TOWHEE. *Pipilo erythrophthalmus erythrophthalmus*. 8.4 in.

The Towhee, Chewink, or Ground Robin, is one of our common birds in the eastern United States but many casual observers are not acquainted with it. It breeds from the Gulf into southern Canada, and winters from Virginia and Kentucky southward.

The head, throat and upper parts as well as spots on

wing and tail of the males are jet black. White patches occur also in the wing and tail feathers. On the sides of the breast and almost concealed when the wings are folded is a rich brown patch on either side. The females have the black replaced with dull brown. The male is a handsome bird with dark red eyes.

How many times have I been passing through the timber when a low rustle of the leaves gave promise of a grouse or pheasant. I pause, again and again, only to be deceived each time by some industrious towhee. Towhees often jump backward throwing the leaves in all directions, thus exposing the bare earth where these useful birds pick up choice morsels in the form of insects, worms and seeds.

"Chewink" is the call or alarm note and the song is suggestive of "Tow-he-eeee," being uttered when the male mounts a low limb.

Brush piles, fallen logs, or neglected fence corners are favorite nesting covers for the chewinks. They often arrive from the south late in March before the snow disappears, and nest building commences late in April. The nests are usually placed on the ground flush with the surface well concealed by a fallen branch, fern, or shrub. Sometimes a brush pile or low shrub appeals to them and they place their nests of stems and dry grass in these low elevations. From three to five eggs are laid. The background is pale bluish white and the marks are in the form of minute specks and dots of reddish brown. The cowbird often deposits her eggs in the nest of this bird.

595. ROSE-BREASTED GROSBEEK. *Zamelodia ludoviciana*. 7 in.

One of the handsomest of our common North American songsters, the male Rose-breasted Grosbeak may be readily identified by the bright rose-colored blotch on the breast. The same tone may be found on the under side of the wing in both sexes, but this is not clearly seen and cannot be considered a sure field mark. The birds occur from the Atlantic west to the Great Plains and north into southern Canada. Shrubbery along streams or low

saplings are favorite resorts for the grosbeak during the spring and summer months.

The beautiful rose-breasted grosbeak breeds in the northern half of the United States east of the Missouri River, but spends its winters beyond our boundaries. The beauty of the adult male is proverbial; the plumage is pure black and white with a broad patch of brilliant rose color upon the breast and under each wing.

These birds are of vast importance to the agriculturist as they destroy Colorado potato bugs which so few of our birds will eat. When these beetles first swept over the land, and naturalists and farmers were anxious to discover whether there were any enemies to prey upon the pest, the grosbeak was almost the only bird seen to eat them. This favorite bird also destroys many other noxious insects. The vegetable food of the grosbeak consists of buds and blossoms of forest trees, and seeds, but the only damage of which it has been accused is the stealing of green peas. The writer has observed it eating peas and has examined the stomachs of several that were killed in the very act. The stomachs contained a few peas but enough potato beetles old and young, as well as other harmful insects, to pay for all the peas the birds would be likely to eat in an entire season. It deserves full protection. A small potato field was so badly infested with the Colorado beetles that the vines were completely riddled. The grosbeaks visited the field every day and finally brought their fledged young. The young birds stood in a row on the topmost rail of the fence and were fed with the beetles which their parents gathered. When a careful inspection was made a few days later, not a beetle could be found, so the birds had saved the potatoes.

The male, though a fine songster, makes himself useful by relieving the female of the duties of incubation, often singing while on the nest. In molting the feathers come off in patches, leaving the male a most woebegone bird and a silent one. The new coat of the male is a good match for the sparrow-like dress of the female.

The nests are placed at elevations not to exceed fifteen

feet. They are loosely made of stiff stems and rootlets, very little soft material is used even in the lining. Three or four eggs are deposited in May or June. The background is deep greenish blue and the marks are in the form of specks and spots of deep brown chiefly at the larger end.

597. BLUE GROSBEAK. *Guiraca caerulea caerulea*. 7 in.

The Blue Grosbeak is found on the Atlantic coast in New England westward to the Great Plains. A paler form known as the western blue grosbeak occurs in the Rocky Mountain range, south through New Mexico and Arizona. In the Great Lakes region of Indiana, Illinois, Michigan, and Wisconsin they are of rare occurrence, a shy but beautiful songster. They breed from 38 degrees south into Mexico, wintering south of the United States.

This bird is probably more common in the southern Atlantic states than in any other place. The favorite food is grain, especially rice, therefore the bird may be looked for where this cereal is cultivated. They have a remarkably strong, awkward appearing bill which enables them to crush the hardest seeds.

Neltje Blanchan says: "This bird has the habit of sitting motionless with a vacant stare many minutes at a time. This impresses one with the fact that the bird must be stupid, but they are exceedingly wary at times and will not permit close inspection.

"When seen in the roadside thickets or in tall weeds such as the field sparrow chooses to frequent, it shows little fear of man unless actually approached and threatened. Whether this fearlessness comes from actual confidence or stupidity is not certain. Whatever the motive of its inactivity, it accomplishes the desired end; for its presence is seldom suspected by the passer-by, and its grassy nest on a tree branch containing three or four pale bluish-white eggs is never betrayed by look or sign to the small boy."

This species makes an interesting pet. It is fond of hemp seeds and becomes very much devoted to its keeper,

but is apt to become melancholy and refuse food, if placed in strange surroundings after being kept for some time as a pet in one household.

The nest is of grass, in bushes or in high weeds. Three or four pale bluish white eggs are laid.

598. INDIGO BUNTING. *Passerina cyanea*. 5.6 in.

The Indigo Bird of eastern and middle North America is about the size of our goldfinch and is the only small bird we have with us whose plumage is entirely blue. The female is very plain and her plumage is suggestive of the female bobolink or scarlet tanager.

The indigo bunting, with the red-eyed vireo, dickcissel, and field sparrow, comprises the Noonday Quartette. These birds sing during the heat of the day when other songsters are silent. The indigo bunting sings through August when most birds are no longer heard. It loves to haunt the highest bough of a shade tree, sing sweetly for a few seconds and then launch into the air continuing to sing as he descends obliquely to a lower brier or sapling. The males seem to prefer conspicuous places and seldom alight except on the outermost branches of trees and shrubs. They are seed eaters, also partaking of small berries and insects, so are beneficial to the agriculturists.

They do not arrive from the south until well into May when the foliage is advanced. Though breeding as far north as Minnesota and Nova Scotia, two broods are reared in a season. The first nest contains eggs about June 1st. Low situations, particularly brier bushes and haw, are favorite nesting sites. The three or four eggs are pale bluish white. The nest is constructed outwardly of dead leaves and sometimes bits of paper are used. The lining is of fine grass and a little horse hair. The abodes are well hidden in dense places, and the males often retire fifty or one hundred yards from the nesting site, thereby sparing the female any uneasiness because of her mate's conspicuous plumage. The edges of timber tracts, roadsides, and pastures overgrown with shrubbery are usually

haunts of the indigo bird, whose company is shared by the towhee and little field sparrow. Sometimes the indigo bird becomes very familiar and decides to nest in the little berry patch just back of the dwelling on a quiet street in our smaller towns. More than formerly, they are now seen along the hedges and lanes in the country sitting on telephone wires.

The cowbird frequently deposits her eggs in the nests of this blue finch.

601. PAINTED BUNTING. *Passerina ciris*. 5.2 in.

The Painted Bunting, Nonpareil, or Mexican Canary, occurs in the southern states from Florida and Carolina westward to the eastern portions of Texas, usually wintering in the tropics. A few reach the Ohio valley in southern Illinois and Indiana. In the South they are favorite cage birds and readily become reconciled to small quarters. Like the indigo bunting the male is a strikingly colored bird, but the plumage of the female is plain olive green. One variety spends the winter in Florida but does not seek a more northerly climate until about May.

In their winter haunts they are shy and retiring, remaining in dense shrubbery where the country is not under cultivation. Often while singing the males remain concealed among the foliage and are as difficult to observe as is our yellow-breasted chat. Their song may be favorably compared with that of the indigo bunting.

The birds live chiefly upon seeds and berries. Until the young leave the nest, they are fed upon insects and their larvæ. The nests are rather loosely constructed of leaves and stems of grass and are lined with the same material. Low bushes and young trees are the favorite nesting sites, although the birds are sometimes found breeding in the high timber, several nesting at times in a single tree.

Four eggs are laid in May and a second brood is frequently reared in July. The eggs are pale bluish white, quite thickly speckled with reddish brown.

18. FINCHES—CONTINUED.

515. PINE GROSBEAK. *Pinicola enucleator leucura*.
9.1 in.

The Pine Grosbeak, like the crossbills and evening grosbeak, is an inhabitant of northerly latitudes and may be observed in the northern portions of the United States only during the late fall and winter months. As its name would imply it is a lover of evergreen forests. It inhabits the northern portions of both the Eastern and Western Hemispheres. Ernest E. Thompson says, "Its form resembles that of the robin, but the resemblance ceases when we notice the short thick beak and forked tail." Like the evening grosbeak it moves leisurely among the trees; the flight is accompanied by a loud, clear whistle.

These birds become reconciled to cages and make interesting pets. During the mating season their song is extremely sweet and varied. They breed early while snow is still on ground. They feed largely on wild berries like those of the juniper, mountain-ash, sumac, etc.

The nests are of twigs, rootlets and finer materials placed at a rather low elevation in some coniferous tree. The three eggs in my collection were laid by a pair of birds which Mr. O. W. Knight, a Maine bird student, kept in captivity. They are deep greenish blue sparingly spotted with dark brown.

517. PURPLE FINCH. *Carpodacus purpureus purpureus*. 6.2 in.

The Purple Finch nests in the mountainous regions of New York, but the favorite summer home of this little fellow is through northern Wisconsin, east across the northern tier of states and well up into Canada. The name in describing the color of this bird is slightly misleading, the plumage being more red than purple. It is a clever little songster. Led by a roving disposition, during the winter it wanders over temperate North America, visiting our city parks, orchards and shade trees, though its fondness

for fruit buds and blossoms makes it no favorite of the fruit grower.

The nests are usually placed in coniferous trees, sometimes a fruit tree is selected. Grass, roots and feathers are used in the outward construction of the nest, lined with long horse hairs. In appearance, size, and construction it bears a strong resemblance to the chipping sparrow's nest. The eggs like the nest are also suggestive of the chipping sparrow but is larger.

521. CROSSBILL. *Loxia curvirostra minor*. 6.2 in.

The American Crossbills, or Red Crossbills, are great wanderers. Their appearance in any locality is erratic and, while we consider them as a winter resident in the United States, we should not be surprised to encounter them during any month of the year. Their range seldom extends beyond the southern boundary of the states bordering the Great Lakes. The males are considerably brighter in color than their mates. The feathers are marked with red only on the tips, and at close range the observer might not feel justified in calling them red crossbills. Their habits remind one of a parrot. In moving about the trees they often progress by means of both feet and bill. It is not an uncommon occurrence to see them grasp a twig in their beak and thus pull themselves along the branch. When cracking seeds or when eating fruit the morsel is sometimes held in the claw as they eat while perched on one foot.

The formation of the freak beak facilitates the removal of seeds from the cones of the various coniferous trees. As many of these trees do not bear cones some years, the crossbills are of uncertain occurrence. Their movements are never hurried by frigid weather. A few years ago one of my correspondents discovered a colony of crossbills comprising both varieties, the red and white-winged, nesting in the virgin forests of Nova Scotia. The birds were sitting upon their nests in February when the temperature was 10 to 20 degrees below zero.

I have a nest and four eggs of each species sent me

from this locality. The nests are of broken twigs, green moss and hair, matted together and warmly lined with moss and fur. The nests in this colony were placed in coniferous trees at elevations ranging from 20 to 60 feet.

The western form of the crossbill has been known to nest in the higher altitudes of Montana. Some years ago while spending the early spring and summer in eastern Michigan a number of crossbills were wandering about a large grove of pine and spruce. We hoped for an opportunity to study the home life of a pair of these birds which had begun to nest in a remote corner of the college campus, but a sudden rise in the temperature caused the crossbills to make a hasty departure for the North.

I was playing golf one August afternoon when I noticed a sparrow-like bird bathing in a pail of water. I was surprised to discover that the unsuspecting visitor was a red crossbill. I could not account for his appearance in Chicago at that time of the year, but the incident is in keeping with the eccentric nature of the species.

528. REDPOLL. *Acanthis linaria linaria*. 5.3 in.

The Redpoll might properly be called the American linnet. In general habits and appearance these birds resemble little sparrows, but they have the distinctive undulating flight possessed by the goldfinch and a little call note which accompanies each downward swoop. Like the Bohemian waxwings and American crossbill their summer home is in the fur countries, but occasionally they have been known to appear in the northern portions of New England. During severe winters they may be observed about the Great Lakes region of Illinois and Indiana, about the same time we look for the hardy pine grosbeak or jolly snowflake and the wary raven. Their appearance in the central states is unquestionably due to the scarcity of food in more northerly latitudes. They are familiar birds and resort to our gardens and orchards to feed on grass and weed seed. Easily tamed they make interesting pets.

The eggs of this species found in collections, like those of the snowflake, usually come from Iceland. I have four eggs which were taken from a nest of grass and moss lined with hair and feathers.

533. PINE SISKIN. *Spinna pinus*. 5 in.

The Pine Siskin, or Pine Finch, is with us merely as a winter visitant. It occurs throughout the continent, breeding mostly north of the United States. At first glance this bird suggests one of the sparrow flock, but the siskins are less quarrelsome, more dignified and partial to budding trees or wheat fields. A captive siskin in the possession of the writer shows great intelligence and eats freely from the hand. His cage contains a large wheel in which the bird revolves with great rapidity, hopping from perch to perch. He enjoys singing in an undertone, apparently only for the benefit of himself.

In the wild state siskins show a fondness for coniferous trees and often move about in company with the redpolls and purple finches. It is erratic in its movements like the crossbill.

The eggs of the siskin are pale blue, delicately marked on the larger end with spots of black. These are placed in a nest of stems, hair, rootlets and moss matted together and placed in a branch of a tree, often at considerable height from the ground.

534. SNOWFLAKE. *Plectrophenax nivalis nivalis*. 6.9 in.

The Snowflake ranges throughout the northern part of the northern hemisphere, breeding in Arctic regions; south in winter to Illinois and Pennsylvania.

The snowflake, or snow bunting, is the true snow bird. It is a sociable creature, visiting the Great Lakes region during our severe weather in company with longspurs and horned larks. Like the snowy owl the range extends to the far north. The food consists principally of weed seeds, which they gather about meadows, pastures, and stubble land. Particularly fond of the black bind weed and fox-

tail grass, they are a most useful bird. In their evolutions they present a pretty sight, and have a pleasant mellow chirp which is quite impressive when uttered simultaneously by several score of throats.

The little fellow should be readily distinguished from all other finches as it is the only white form. It is strictly terrestrial, never alighting in trees, but is sometimes seen on rail fences or on the roofs of outbuildings. Like the horned lark it walks and does not hop. Snowflakes are of an optimistic disposition considering the scarcity of suitable food during our severe weather, which scarcity often forces them to visit our homes and barnyards. Nevertheless, during zero weather they may be seen playfully chasing each other over the snowdrifts as do the bobolink during the balmy days of June. But few American collectors have ventured to the far north where this little bird breeds. Oologists usually obtain the eggs from Iceland. The eggs numbering four to seven are pale greenish white, lightly blotched with pale brown.

536. LAPLAND LONGSPUR. 6.2 in.

The Lapland Longspur is a common winter resident in the Great Lakes region and New England States. This bird breeds in the far north but descends upon the prairies and fields of central North America in company with Smith's longspur and the snow bunting during severe winters. The birds possess a bright chestnut patch on the nape of the neck. The rest of the plumage is a mixture of black and white.

537. SMITH'S LONGSPUR. *Calcarius pictus*. 6.6 in.

Longspurs have the nail on the hind toe remarkably developed, enabling the birds to scratch in weedy sections for various seeds and insects. Longspurs are found in flocks except when nesting. They visit the central portions of the United States often in company with horned larks and snowflakes. They are sociable little fellows, often calling to each other as they move over the snow-covered prairies in immense flocks.

Smith's longspur, or the painted longspur, as it is frequently called, may be found at the southern part of the Great Lakes region from November until April. It is a handsome bird with a black and white head; the rest of the plumage is a rich coppery brown. The female is decidedly paler and inconspicuous. The territory through the Saskatchewan and Mackenzie River regions is the breeding grounds of the painted longspur. Longspurs have been met with in summer as far north as the Arctic coast and upper Yukon valley, in winter they reach as far south as Tennessee and northern Texas.

I have four eggs taken by a missionary in the Mackenzie River region. They are clay colored and clouded with obscure blotches of dark purplish brown. The nest was in a tussock of grass and composed of moss and fine stems. The nests are sometimes lined with a few large feathers from the wild fowl that breed in the same territory.

567. SLATE-COLORED JUNCO. *Junco hyemalis hyemalis*. 6.3 in.

The Junco ranges throughout North America, breeding from northern Minnesota and New York northward and along the Alleghany mountains to Virginia, wintering southward to the Gulf.

This bird is commonly known as junco, or black snow-bird. This is the only representative of the large junco family east of the Rocky Mountains. Like the vesper sparrow, the outer tail feathers are white, serving as a convenient field-mark. The upper breast is a dark mouse color and the upper parts in the male are slaty gray, usually slightly lighter than the coloring on the breast. The plumage of the female is considerably lighter. The bill and legs are pinkish or flesh color.

Occasionally these sociable little fellows spend the winter in southern Wisconsin and northern Illinois and Indiana. Were it not for our snowfalls, we would undoubtedly have them with us as a winter resident. They feed upon the ground, faintly calling to each other in a low little chirp, occasionally bursting into a sweet song which

is a favorite melody during March and April, when the birds are moving toward their summer quarters.

They nest commonly in northern Michigan, Wisconsin, and Minnesota. In their summer haunts the junco retires to dense forests, building a nest in crevices along little ravines under the roots of upturned trees or among fallen logs where the country is almost inaccessible. Their demeanor is quite different from that of the migrating junco which visits our dooryards picking up the bread crumbs or feed about the barnyards.

The nest is composed of hair, rootlets and stems. Three or four eggs are laid. The background is greenish blue and the larger half of the egg is marked with red dots often forming a wreath about the larger half of the shell.

These birds breed abundantly through Vermont, New Hampshire, Maine, New Brunswick and Nova Scotia.

604. DICKCISSEL. *Spiza americana*. 6 in.

The Dickcissel, or Black-throated Bunting, is at times of erratic occurrence. They breed in Mississippi valley from Texas to Minnesota, wintering in Central and South America. Some years they are abundant in certain localities in northern Illinois and perhaps the next year few are seen. The male in appearance might remind one of our common cock sparrow with his jet throat. A closer inspection will reveal that the throat of the dickcissel is bordered with light yellow. The song of the male is "Dickcissel-cissel" oft repeated; by no means musical and with a monotonous repetition continued for hours at a time. During the hottest days of July and August, four to eight birds may be in voice at the same time. These field birds call from a fence post, wheat stalk, little tree or telephone wire.

The dickcissel feeds upon crickets, bugs, weed seeds and sometimes wild fruits, such as strawberries. It is always the farmer's friend.

The female is a very plain and rather shy bird. The first nests are usually placed on the ground or a few inches above the earth in a tussock of grass. The four or five

eggs laid in early May are plain light blue. Late in July or early August the dickcissel raises a second brood and this nest is usually placed in a low bush or shrub. Stems, coarse grass, and horse hair enter into the composition of the nest. Plant fibers such as Indian hemp is frequently used externally, giving the nest an artistic appearance.

19. INSECTIVOROUS BIRDS.

Tanagers are American birds found principally in the tropics. Of the three hundred and fifty species only five reach the United States. They spend most of their time in wooded lowlands where they feed upon insects and fruits. The males are remarkable for the brilliancy of their plumage. Few are beautiful songsters, among them, however, is our scarlet tanager.

Swallows are decidedly insectivorous. They feed while upon the wing and travel great distances apparently unfatigued, as their flight is the most remarkable of that of any family. The feet are weak, being little used. They nest in pairs and in colonies and migrate in large flocks by day.

Waxwings are highly gregarious except while breeding. These handsome but songless birds feed upon insects, berries and fruit. They receive their name from the wax-like tips on secondaries and sometimes on tail.

Shrikes, though representing about two hundred species, are mostly Old World forms, only two varieties being found in America. They prey upon insects, birds, and small mammals which they impale upon thorns or fence barbs until such time as they choose to satisfy their appetites.

Vireos are peculiar to America. Of the fifty species fifteen reach the United States. These insectivorous birds are arboreal and slow of movement, gleaning food from leaf and bark surface mainly. Their plumage has a greenish or grayish cast, harmonizing well with the foli-

age in which they feed. They are good songsters and construct beautiful nests.

QUESTIONS.

Why are tanagers and cardinals often mistaken for each other? Compare them. Why is the female tanager less brilliantly adorned than her mate? Compare "red-winged blackbird" and "black-winged redbird." Why are not swallows permanent residents in cold countries? Why are they all so useful? Is a swift closely related to the swallow? Why the name "waxwing"? Why do swallows migrate by day? Why may shrikes remain in cold climates in winter while swallows and vireos seek sunnier skies? Show the economic value of each of the above group of birds. Which birds will nest about habitations of man? Which may we attract by offering homes?

608. SCARLET TANAGER. *Piranga erythromelas*. 7.2 in.

Most Tanagers are tropical, inhabiting the densely foliated trees about the equator. The Scarlet Tanager summers in the United States and southern Canada, wintering in Central and South America. The male bird, with fire-red body and jet-black wings and tail, is our most brightly plumaged bird, while the female has a sober plumage of dull olive green. The scarlet tanager is a comparatively common bird from Iowa and Minnesota eastward to New York and the Canadian provinces. Decidedly a warm weather bird, it does not arrive in the Great Lakes region until about May 1st. These birds are highly beneficial as they destroy countless numbers of worms, moths, caterpillars and beetles, while partaking of some small fruits and berries.

The song of the male is clear and pleasing, uttered rather distinctly as a rhythmical carol suggesting that of the robins. Timbered hillsides, orchards and shade trees are favorite nesting sites. The nest, composed of coarse stems and grass lined with finer material of the

same, is attached to a cluster of small twigs on a limb of a deciduous tree, usually within twenty feet of the ground. The three or four eggs are bluish green spotted distinctly with brown.

611. PURPLE MARTIN. *Progne subis subis*.
8 in.

The Purple Martin, with his near relative and subspecies called the western martin, occupies about the entire portion of temperate North America, breeding as far north as Newfoundland and Saskatchewan.

The plumage of the male is deep purple as the iridescent feathers glisten in the sun with a beautiful metallic effect suggestive of the head and throat of the bronzed grackle.

Martins are strong fliers and successfully ward off the attacks of the English sparrows and the kingbird. Sociable birds frequently nesting in colonies, they readily adapt themselves to "apartment" life by accepting as nesting sites bird cotes which are erected for their accommodation. Such houses should be furnished more often. Pupils may be encouraged to make and put up these houses. The birds also nest in the structural work of bridges and in the crevices and under the roofs of buildings. They even place the nests on the cross-boards above the hanging arc lights which are lowered daily by the electricians. Martins are decreasing in numbers in the North and efforts should be made to keep this valuable bird with us by furnishing them nesting sites.

The food is entirely insectivorous and these highly useful birds are most active shortly before sunrise and near sunset. One observer noted that the parent birds visited the young more than two hundred times in a day carrying insect food to them. Martins twitter and chatter in an agreeable way, and the song of the male as he seems to wax his bills together is not grating in quality, as we might suppose, but exceedingly pleasing. I have often

wondered why so little is said by naturalists about the song of the purple martin.

The nests are composed chiefly of grass and feathers and contain four or five pure white eggs, laid in June. The birds are with us from the latter part of April until August.

612. CLIFF SWALLOW. 6 in.

The Cliff Swallow, or Eaves Swallow, nests under the eaves of barns and on the perpendicular cliffs or rocks along water-courses. These gregarious birds return annually to the same sites where the nests of clay are securely attached to the cliffs or caves. The birds enter and depart from their gourd-shaped nests through a cylindrical opening from below in the structure of clay and grass.

613. BARN SWALLOW. *Hirundo erythrogaster*. 7 in.

The Barn Swallow is probably the most generally distributed of our swallows as several pairs may usually be found about the average rural home, nesting in barns and outbuildings. They formerly used rock caves and cliffs. Though sociable in habits they do not colonize like the cliff swallow. These birds range north to Greenland and Hudson Bay, breeding throughout most of the range and wintering in Central and South America.

The bird is of great economic value as the food is entirely insectivorous, being captured while the birds are on the wing. Too many ignorant farmers knock down the nests and drive away these true friends. The deep forked tail serves as the best means of distinguishing this swallow from martins, swifts, and other rapid fliers. The song of the male is a mild little twitter, uttered from the rafters or while he is swiftly pursuing insects over the meadows.

Swallows are often called the first masons. The nests are placed about buildings, preferably inside on a rafter or beam. Mud of a clay-like composition mixed with blades of grass and hay form the exterior of the

nest in which, when available, feathers are used as a lining. The birds frequently allow one section of the nest several days to set before adding fresh material.

Four to six pearly white eggs sprinkled with dots of brown or lilac are laid late in May or early in June. The eggs hatch in ten days and the young leave the nest when they are about sixteen days old.

614. TREE SWALLOW. *Iridoprocne bicolor*. 5.9 in.

Tree Swallows occur throughout eastern North America, principally in the middle and northern states, ranging north to Labrador and Alaska, breeding locally throughout the range, and wintering from South Carolina southward.

This bird is frequently called the white-bellied swallow, as the under parts are pure white, a field-mark which readily distinguishes it from our other swallows. The upper parts are steel blue in color, the feathers having a glossy metallic luster.

The feet of the tree swallows show little development. The birds are seen perching on the naked branches of trees more frequently than are our other swallows. The note is a little twitter, indicative of little demonstration, and the only vivacious movements are those made in flight as the birds possess perfect control when in the air and are most at home on the wing.

The tree swallows do not nest in colonies, like the cliff or bank swallows, but flock early in August when immense numbers congregate on the marshes and, in company with the bank swallows, move leisurely southward as one great army of insect catchers.

The nests are commonly placed in hollow trees and stumps, usually some old, abandoned excavation of a woodpecker is used, though some accept houses made for them by man. Nesting sites near the water are preferred. Often a decayed stump standing in the midst of a vast marsh is selected and the cavity is warmly lined with grass and feathers. Four to seven white eggs are laid.

616. BANK SWALLOW. 5.2 in.

Bank Swallows are very common birds in eastern North America where they breed in colonies. Dozens of these birds nest in the side of sand or gravel banks so that the many perforations would convey the impression that the bank or cliff has been subject to a bombardment. The little birds line these cavities with dry grass and feathers. This swallow may be distinguished from our other common swallows by complete absence of gloss or iridescence in any part of the plumage.

617. ROUGH-WINGED SWALLOW. 5.7 in.

The Rough-Winged Swallow is nowhere an abundant bird but is distributed generally throughout eastern North America. It is less gregarious than any of the other swallows. The nest of old yellow grass is usually constructed in a hole or crevice about an old quarry, cliff, or ravine. The birds are slightly larger than the bank swallows and are without the bank swallow's dark band across the breast.

618. BOHEMIAN WAXWING. *Bombycilla garrulua*. 8 in.

Mr. Dawson writes: "Perhaps we shall never know just why some of these gentle hyperboreans spend their winters now in New England, now in Wisconsin, now in Washington, or throughout the northern tier of states at once. Their southward movement is doubtless induced by hunger, and the particular direction may be determined in part at least by the prevailing winds. They are likely to appear in the limits of their range any winter. Usually they appear in flocks of several hundred individuals.

"The northern waxwing is a bird of unrivalled beauty, even surpassing that of the cedar waxwing, which it closely resembles in appearance and habits. When with us it feeds by preference upon the berries of the mountain-ash and the red cedar, and more rarely upon persimmons. Its life history is as yet imperfectly known although,

it has been found breeding near the Yukon and Anderson Rivers."

619. CEDAR WAXWING. *Bombycilla cedrorum*. 7 in.

The Cedar Waxwing is so called because of red tips, like drops of sealing wax, on secondaries and sometimes on tail.

The entire continent of North America is inhabited by either the cedar or Bohemian waxwings, but the eastern and central portions from Labrador south to Central America are the principal roving grounds of the "cedar bird." Here they may be met with throughout the year, provided their food supply of berries, seeds, and buds is sufficient to sustain the flock until spring when the hordes of insects appear.

The cedar and Bohemian waxwings are the only representatives of this interesting sub-family, Ampelinae. The former species is distinctly an American bird, but the range of the Bohemian waxwing includes the northern portions of America, Europe, and Asia.

The various hues in a cedar waxwing's plumage, like the velvety effect in shades and colors of the harlequin duck and Wilson's phalarope, are soft delicate tones. To appreciate this exquisite combination it is essential that the birds themselves be seen.

A sociable bird with an eccentric disposition, the cedar bird, or cherry bird, wanders about the country in flocks of from five to fifty. The raids made by a company of these birds when they descend upon orchard and shade trees which are infested by the canker-worm or elm leaf beetle has proven a blessing to many a horticulturist whose trees they often save. When the early Richmond cherries ripen the "Cherry Birds" gather about the trees in numbers. Overlooking both the past and future, the farmer often shoots these valuable birds. When the cherry season is over the birds gradually pair off and withdraw from the flock preparatory to nesting in some coniferous shade tree, bush, or orchard tree.

In southern Michigan I observed the birds breeding

not earlier than July 20, and many nests are not occupied before August 5th. Nest-building is commenced earlier in the southern states, and young cedar waxwings may be seen in June.

On August 4, 1896, I found a nest of grass, stems, and wool, situated fifteen feet up in the crotch of an apple tree. The crest of a cherry bird was visible above the rim of the nest. Ascending to the nest, I found five bluish slate-colored eggs speckled with black and with under shell markings of pale blue, which gave a cloudy or smoky appearance to the eggs. See Chart 25. Another nest holding four incubated eggs was discovered on August 16th in the vicinity of the former nest.

622. **LOGGERHEAD SHRIKE.** *Lanius ludovicianus ludovicianus*. 9 in.

The Loggerhead Shrike, Butcher Bird or Mouse Hawk, appears from Florida northward to New York and westward to Indiana; from the latter state westward to the Plains and north into Michigan, Wisconsin and Minnesota, we have a closely allied species described as the migrant shrike; another sub-species, a still lighter form, ranging west to the Pacific Coast, is called the California shrike.

Shrikes are solitary and are seldom abundant, but are easily observed because of their habit of frequenting conspicuous places. They resort about thorny hedges along highways so that occasionally several pairs may be observed within a distance of half a mile along a country road, and then one may not encounter another for several miles. Their peculiar flight should enable the observer to recognize the birds as the white patches on the wings and tail are conspicuous field-marks.

Commonly known as the butcher bird, these savage, carnivorous birds eagerly devour the brains of their victims. On thorns and barbed wire fences are impaled the bodies of sparrows and mice, and often grasshoppers and snakes meet a similar fate. Shrikes possess a hooked beak, suggestive of the hawk, but they have weak feet as do

other perchers. This largely accounts for the peculiar habit of impaling the prey to be held while eaten. They perch in a manner similar to the flycatchers and instead of pursuing their prey they remain patiently in a conspicuous place awaiting the approach of some tempting morsel, when they suddenly descend upon the unsuspecting victim. The shrike has a habit of accumulating a store of birds or insects on barbs or thorns, even after his hunger is satisfied. It is supposed they return if hungry, though they seem usually to have fresh meat for their meals.

The loggerhead or migrant shrike is with us in the Great Lakes region from early March to October. These birds seem to prefer comparatively open level areas and frequently are seen perching upon fences and telephone wires. In many cut over regions, especially if placed under cultivation, these birds are breeding in greatly increased numbers. These prolific birds lay five or six eggs, occasionally rearing two broods in a season. They invariably attempt to rear a brood if the first or even the second setting is destroyed.

The shrikes nest early, frequently sitting upon their eggs during the cold days of April when the wind sweeps with full force across the prairies. They prefer sites in hedges or thorn bushes. The nests are warmly built of vegetable fibers, stems, and hay warmly lined with Indian hemp and feathers.

624. RED-EYED VIREO. *Vireosylva olivacea*. 6.2 in.

The Red-eyed Vireo, probably the commonest of the vireos, inhabits North America as far west as the Rockies, ranging from the Gulf to Hudson Bay. All members of the vireo family are natives of America, though most are inhabitants of tropical and sub-tropical regions. The prevailing colors of these birds are various shades of light green and gray which harmonize admirably with their surroundings.

How many people have I encountered who ask me to name "the bird that sings all day long in the shade trees

about our lawn." Catch a glimpse of the red-eyed songster and you will be surprised to learn that the glad volume of song which is entertaining you throughout the day and evening during the torrid heat of July and August issues from the throat of so small a bird. Seek an introduction to this vireo and you will find him equally curious to see you. As to forming an acquaintance with him that is another matter, as he commences to sing in a manner which would indicate from the rising inflection of his voice that a closer acquaintance is not desired.

These birds are decidedly insectivorous and devour great quantities of injurious worms and insects and their larvæ.

The nests of the different species do not differ greatly from each other in construction or situation. In country places where huge shade trees overhang the village streets the vireos revel among the foliage, constructing their pensile nests among the drooping branches of some elm, sycamore, or maple.

A nest of three eggs in my collection taken May 15, 1896, is composed of bark, fibers, string, and down lined with long coarse hairs. The nest was suspended at the end of a maple limb ten feet from the trunk of a tree twenty-five feet from the ground.

629. BLUE-HEADED VIREO. *Lanivireo solitarius solitarius*. 5.5 in.

The Blue-headed, or Solitary, Vireo ranges from the Atlantic west to the Great Plains, practically from the southern tier of states northward, wintering from Florida to Brazil. Dr. Elliot Coues describes its song as "pitched in a higher key than the other vireos." It is by no means the recluse that its name would imply. Mr. Bradford Torrey writes: "A bird of winning tameness. Wood bird as it is, it will sometimes permit the greatest familiarities. I have seen two birds which allowed themselves to be stroked in the freest manner while sitting on the eggs and which ate from my hand as readily as any pet canary."

The blue-headed is one of the first vireos to arrive in

the spring and last to depart in the fall. It sings at its work and many consider it the finest singer of the family.

The pensile nest of pine needles, plant down, etc., suspended from a forked branch five to ten feet up usually contains three or four eggs.

631. WHITE-EYED VIREO. *Vireo griseus griseus*.
5.3 in.

The White-eyed Vireo ranges throughout eastern United States from Florida to the northern tier of states, wintering from Florida south.

"Vireos are valuable gleaners and may be distinguished from other tree inhabiting, greenish birds of similar size by their habit of carefully exploring the under surfaces of leaves and the bark including the various crevices. These highly musical little birds have songs and call notes which may be quickly recognized once they are known.

"Unlike our other vireos, the white-eyed lives in the lower growth. He is, therefore, nearer our level and seems to trust us more than do the others that call from the tree-tops. He has a variety of musical calls and sometimes may be heard softly singing a song composed largely of imitations of the notes of other birds.

"The white-eyed may readily be known from the red-eyed and warbling vireos by the white bars across the tips of its wing coverts. In this respect it greatly resembles the yellow-throated, but it is to be distinguished by its smaller size, white iris, and white breast, only the sides of the breast being tinged with yellow." (Chapman.)

In construction the nest is very similar to that of our other vireos but Wilson, the ornithologist, named this bird "Politician" because it frequently uses bits of newspaper in the construction of its nest.

20, 21. WARBLERS.

Warblers are found in America only, and with a few exceptions are arboreal, hence the term "wood warblers." They are almost exclusively insectivorous, hence highly

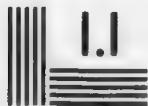


MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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migratory and useful. More than all other birds, are they the victims of lighthouses and electric lights in cities, as they migrate by night. They are more or less gregarious and sociable when migrating, several species freely mingling in flocks. The last to arrive in the spring they are the first to leave in the fall. They may be plentiful one day, and have entirely disappeared the next. They are mostly brightly plumed, but only a few are skilled as vocalists. The amateur nature student is apt to confuse finches and warblers. The tide of warblers passes through the United States when the fruit trees are in bloom and the birds are of great benefit in destroying insects which are then awaiting the opportunity to attack the young fruit.

In procuring food, some take insects from exposed parts of twigs and leaves, some carefully search the under parts of leaves and the cracks and crevices of trunk, etc., while others catch a large part of their food on the wing. Bird lovers take delight in studying them through opera glasses, constantly finding new species at times of migrations.

642. GOLDEN-WINGED WARBLER. *Vermivora chrysoptera*. 5.1 in.

The range of the Golden-winged is the eastern United States, breeding from Indiana and northern New Jersey north to Michigan, southern Ontario, and Vermont, and south along the Alleghanies to South Carolina. It winters in South America.

"The first glimpse of a new warbler is always memorable, but an introduction to this dashing young fellow is especially so. You may have looked for years in vain, when suddenly one May morning you come upon him in the swampy woods, restless, full of life, and in the highest spirits. The young hickories are just about to open their reluctant palms, the gallant mounts a high bud, throws back his head, and sputters out, 'Zee, zee, zee, zee, zee,' in double time in comparison with his drowsier relative, the blue-wing. Without waiting for applause he charges after a vagrant fly, snaps him up, and takes to a sweet smelling spice-bush for another round of music. A pass-

ing vireo, which by the way was born thereabouts, is fiercely assailed by the swaggering stranger, and retires in confusion." (Dawson.)

The nest of stems, pine needles, leaves and grasses is placed in a clump of weeds, tussock of grass or small shrub. The situations most liked are woodland pastures or weedy fields. The four or five eggs are white, speckled with dark brown and purple.

648. PARULA WARBLER. *Compsothlypis americana americana*. 4.5 in.

The range of the Parula Warbler is eastern North America, breeding from the Gulf to Canada, and wintering in Florida and south.

The head and throat of this warbler is deep bluish gray, becoming much blacker on the breast. This appearance has suggested the name parula warbler. Parula warblers have been subdivided and are described as northern parula and the parula. As usual we find the larger or hardier bird visits the more rigorous climates, as the northern parula, inhabiting the states bordering the Great Lakes and New England, is slightly larger than the parula which may be found south of the Ohio River, ranging from the Atlantic coast to Texas. Both varieties are frequently called the blue yellow-backed warbler.

The food consists of spiders, small insects, including flies and various other winged forms, and caterpillars which they are very industrious in gathering from underneath leaves and inconspicuous branches of the trees they frequent. Like other warblers they are highly useful to horticulture.

Aside from the cerulean warbler probably no other member of this family lives at so great an elevation above the ground except those forms which are partial to coniferous trees. The peculiar song ends in a little screech.

Sometimes these birds nest in small colonies. Like the cedar waxwing and dickcissel they are irregular residents, breeding in some parts during certain years and perhaps they are not seen again in the same locality for several seasons.

Their manner of nest-building is unique, as they are partial to trees which are draped with usnea moss. Among the hanging festoons of this "Spanish moss" the little birds construct a cavity into which they carry soft vegetable substances such as thistle-down and the "cotton" of the cottonwood. The nests are difficult to detect unless one is fortunate enough to observe the birds when they are entering these long appendages. Usually four white delicately wreathed eggs are laid in May.

654. BLACK-THROATED BLUE WARBLER. *Dendroica caerulescens caerulescens*. 5.2 in.

The "Black-throat" haunts the underbrush, particularly laurel, maple and oak shrubs. May and September are the months we have this bird with us as a transient through the middle United States. It breeds from the Adirondack, Alleghany, Green, and White Mountains, west through northern Michigan, Wisconsin and Minnesota, northward to Labrador, wintering in the tropics.

The majority of our warblers have yellow or the bicolors, orange or green, in some parts of their plumage. This handsome little fellow, like the cerulean, is blue above, but the back, head, wings, and tail are much darker than the corresponding parts in the sky blue cerulean. The throat is black, lower breast and under parts white. The female has the blue replaced with greenish brown, but either sex may be distinguished by the white patch on the wing.

In 1905 I encountered several males in full song in northern Wisconsin. They were conspicuous while singing as they perched upon low branches overlooking an open spot in the timber, preferably where the ground was uneven. Throwing back their heads and swelling their throats, their song was a dainty imitation in style and quality of that of our dickcissel. Three years later I revisited Butternut Lake, Wisconsin, and after locating a couple of birds singing on a bushy hillside, I carefully searched the maple saplings until I was rewarded by find-

ing a nest. The four pearly white eggs were beautifully wreathed at the larger end with dull reddish brown.

655. MYRTLE WARBLER. *Dendroica coronata*. 5.6 in.

The Myrtle Warbler ranges through eastern North America, breeding north of the United States and wintering from the Middle States southward.

The myrtle, or yellow-rumped, warbler is one of the largest and commonest of the family. It occurs chiefly east of the Mississippi River and is represented on the Pacific coast by an Alpine form known as the Audubon's warbler. While the myrtle warblers differ decidedly in plumage, either sex may be identified by the bright yellow patch at the base of the tail feathers. This is clearly distinguishable when the bird flies or moves about through the brush. Like most of our warblers, the myrtle is a migrant in the Great Lakes region, arriving ahead of most insectivorous birds, even before the foliage is out. While there are no records of myrtle warblers' breeding in the United States, strangely enough this bird has been found breeding in Jamaica, West Indies.

The birds show a decided preference for coniferous trees and may be found nesting in cedar and hemlock forests in company with magnolia, Blackburnian, and black-poll warblers.

The nests are constructed of fine stems and grass, lined with a few hairs and feathers.

679. MOURNING WARBLER. *Oporornis philadelphia*. 5.6 in.

The Mourning Warblers inhabit the eastern portions of the United States but are comparatively rare west of the Mississippi except perhaps in Montana. They breed from Nebraska and the New England States northward to New Brunswick and Hudson Bay.

The bird bears a general resemblance to the Connecticut warbler, a rare species; the latter, however, possesses a white line about the eye which is always lacking in the plumage of the mourning warbler. This warbler feeds,

travels, and breeds in low elevations, being partial to growths of long grass and weeds in low damp woods or roadsides. The simple, clear song has been described as follows: "True-true-true-tu-too," uttered on the ascending scale except the last two syllables, which convey the effect of two low whistles. When feeding or otherwise engaged the birds seem to omit the first three notes, uttering simply the lower tones. Like the little short-billed marsh wren, they are fond of perching on a dead stump and singing persistently for many minutes at a time.

The nests are of fine grass and stems usually placed in a dense clump of grass or between the stalks of some weed or plant growing in damp ground. The background of the four eggs is light creamy and the eggs are handsomely blotched around the larger end with rich brown and lilac.

683. YELLOW-BREASTED CHAT. *Icteria virens*
virens. 7.5 in.

This large warbler inhabits the eastern United States, west to Dakota, Kansas and eastern Texas, north to southern Ontario and southern New England, being a common summer resident in various portions of the states bordering the Great Lakes. It winters in eastern Mexico and Central America to Costa Rica.

Thickets bordering roadsides, streams, and swampy places are the most likely spots in which to look for this bird, it being easier to find him by his notes than by his appearance.

Mr. Frank M. Chapman says: "No other warbler is possessed of the chat's individuality. Although the chat avoids rather than seeks observation, he by no means shuns the habitations of man and, when favorable cover was offered, I have known these birds to nest in a village. Because of the nature of his haunts, he has the bird student at a complete disadvantage. When seemingly almost within reach, he is still invisible and one might well imagine that he intentionally leads him through the most impenetrable part of his haunts merely to enjoy our futile

efforts to see him. If, however, you would see the chat satisfactorily, fight him with his own fire. Seat yourself in a thicket and with pursed lips squeak gently but persistently. Soon there will be an answering 'chut' and with due patience and discretion you may induce this elusive creature to appear before you.

"I do not recall a more suspicious bird than the chat. Even the crow's innate caution is sometimes forgotten, but a chat is always on guard. While the cowbird frequently deposits her eggs in the chat's nest, they are seldom hatched, but are destroyed by the owner of the nest, which owner is apt to peck a hole in all the eggs and desert the nest. On moonlight nights the chat often sings freely. The voice of the bird is flexible to an almost unlimited degree. It has no note suggesting its place among the warblers. The song is almost impossible to describe. It begins with two slow, deep notes; then follows one high-pitched and interrogative note; then several, rapid and even, and from that point on to the end I have never been able to give any rendering of the clucking and gurgling that completes the long song. His love song is a woodland idyl and makes up for much of his shortcomings. From some elevated perch from which he can survey the surrounding waste for a distance, he flings himself into the air, straight up he goes, on flapping wings, legs dangling, head raised, his whole being tense and spasmodic with ecstasy. As he rises he pours forth a volley of musical gurgles and whistles that drop from him in silvery cascades to the ground like fairy chimes."

In addition to the superior size of this warbler it may also be distinguished by its short, stout bill, suggestive of our flycatchers.

The nests are composed of long, light grass and stems, a light but bulky affair, placed in thickets at low elevations. The birds occur quite commonly along the Illinois River. Three or four eggs are laid, usually from the middle of May until the second week in June. The background is whitish and the markings reddish brown, quite thickly distributed over the entire surface.

657. MAGNOLIA WARBLER. *Dendroica magnolia*.
5 in.

The Magnolia Warbler breeds from Minnesota and Manitoba eastward across the northern tier of states and through Southern Canada.

While passing through the middle United States the magnolia warbler is oftenest found moving quietly through the bushes which line the banks of streams or lean over swampy pools in the depth of the forest, where its brilliance seems fairly to dispel the gloom. If one finds His Magnificence fluttering above an insect-laden leaf his cup of joy is full. But the bird is no recluse and numbers of them join that bright array which consecrates our treetops year by year.

The song of the magnolia, though not often heard, is clear and musical and fairly distinctive.

The nests, hidden in evergreens from four to forty feet above the ground, are built of stiff stems, lined with fine stems and a little grass. Four or five eggs are laid in May or June. They are pale bluish white, spotted and blotched with different shades of red and brown.

684. HOODED WARBLER. *Wilsonia citrina*. 5.7 in.

The range of the Hooded Warbler is the eastern United States, breeding as far north as northern Illinois and northern Pennsylvania, and wintering in Central America.

"Take a lump of molten gold fashioned like a bird, impress upon it a hood of steel, oxidized, as black as jet, overlay this in turn with a half-mask of the gold, tool out each shining scale and shaft and filament with exquisite care, and you may have the equal of one of those ten thousand dollar vases of encrusted steel and gold, which the Spanish are so clever at making, an heirloom to be handed down from father to son. But let Nature breathe on it; let the Author of Life give it motion and song; and you will have a hooded warbler, not less beautiful that you cannot handle it, but infinitely more so in

that its beauty takes a thousand forms, a fresh one for every turn of fancy that may stir an avian breast.

"To me the bird first came as a voice, a sweet and pure but altogether puzzling sound, tossed down from a tree-top on a foggy morning, an hour before dawn.

"The hooded warbler shows a decided preference for damp woods where there is plenty of undergrowth. Beech woods are favorite places if the other conditions are suitable. Here the birds spend their time flycatching along the middle levels, or descend to search the brush. The tail is sometimes carried half-open after redstart's well-known fashion; but otherwise the birds are much less fussy than their salmon-spotted neighbors.

"Like most warblers the hooded has a chip note of alarm which is distinctive to practiced ears, while the male has a song which is quite marked, tsu-e, tsu-e, tsu-e, tsu-wee-tsu. The notes are ringing and musical, but the last two contain a sort of vocal somersault, as though the bird were attacked by a sudden inclination to sneeze. These last notes would undoubtedly be mistaken for those of the Acadian flycatcher if heard alone. This is the common song, but some variant forms occur." (Adapted from Dawson's "Birds of Ohio.")

The nests of bark strips, stems, dead leaves and grasses are placed at low elevations in saplings or bushes. The four eggs are flesh colored, daintily speckled with purple and brown.

687. REDSTART. *Setophaga ruticilla*. 5.3 in.

The Redstart ranges from New York, Ohio, Indiana and Illinois northward. With the yellow warbler, Maryland yellow-throat, yellow-breasted chat, and oven-bird, this handsome species represents the small detachment of warblers that spend the summer around the southern borders of the Great Lakes region, especially west of Ohio. The redstart is partial to damp woodlands and shady roadsides. The males flit hurriedly from branch to branch alternately spreading their tails and dropping

the wings. Each move is the personification of nervous energy.

The males have beautiful patches of salmon pink in both the tail and wing feathers. The sides of the body are also tinted with this beautiful shade. The style and color effect is suggestive of the markings in our towhee, but the redstart is much smaller. The plumage of the female redstart is much less conspicuous than that of her mate. The beautiful salmon shade seen in the plumage of the male is replaced by light yellow. Her upper parts are pale brown instead of black.

Decidedly a fly-catching warbler, feeding usually at low elevations, capturing insects on the wing and hunting for their larvæ in the crevices of the bark and under the leaves and stems, mark this beautiful bird as one of our very useful friends.

The song is a hurried little twitter, uttered with a rising inflection of the voice. The nests are placed within ten or twelve feet of the ground and are composed of Indian hemp, fine stems, bark fibers and cobwebs, lined internally with fine round stems. Three or four white eggs, delicately spotted at the larger end with light reddish brown are laid from the middle of May to the middle of June. In spite of the small size of the nest the cowbird frequently deposits one or two eggs in it.

21. WARBLERS—Continued.

636. BLACK AND WHITE WARBLER. *Mniotilta varia*. 5.3 in.

The range of this warbler is eastern North America, breeding north to Fort Simpson, and wintering in Florida and South.

"Although placed at the head of the family of wood warblers, this modest bird comes more naturally into comparison with creepers and nuthatches. He clings and creeps, or rather hops, along the bark of the trunk and the

larger branches. He lacks much, it is true, of being the methodical plodder that the brown creeper is; he covers a great deal more surface in a given time and is content with a rather superficial examination of any given territory. Then again he secures variety, not merely by tracing out the smaller limbs, but by moving in any direction—up or down or sidewise—or even by darting into the air now and then to capture an insect. Not infrequently he may be seen gleaning from the bark of bushes and saplings near the ground, or again in the tops of the very tallest elms. Apple trees are cherished hunting grounds, and it is here that one may cultivate a really intimate acquaintance.

"The black-and-white is among the earlier migrant warblers, coming as it does during the last week in April and before the leaves are well out. At this time it is quite a conspicuous bird, in spite of the fact that its striped coat roughly approximates to the lights and shadows in the bark of a tree; but it is usually silent. When it does speak, a few days later, its voice is a wiry, squeaking song, likely to be lost to ear altogether amid the full chorus of warbler week; but when the rush is over the singer will be heard. At best the song is a tiny sibilation of no great carrying power: 'Squeech, weech, weech, weech, weech,' lisped out in two keys is one rendering." (Dawson.)

637. PROTHONOTARY WARBLER. *Protonotaria citrea*. 5.5 in.

The range of this exquisite warbler is eastern United States, breeding from the Gulf to Central Illinois and Virginia, less common east, and wintering in the tropics.

At first glance we look upon these birds as natives of the tropics because of the brightness of plumage of the males. They confine themselves to river bottoms and usually take possession of hollow stumps where the tree swallows and chickadees are their neighbors. They have not the northerly range the other warblers possess but wander occasionally to the Great Lakes Region.

The birds are more common in Iowa, Illinois and Indiana, breeding in the swamps especially along the Illinois and Kankakee Rivers.

Their alarm note is a distinct "peep" reminding one of the solitary sandpiper or water thrush. When the birds arrive from the south late in April they frequent the treetops, but gradually descend to the willows and early in May they have taken possession of some hollow, usually not to exceed five feet above the ground or water.

The birds are decidedly insectivorous and the regions inhabited by them furnish an unlimited supply of small winged insects, mostly injurious, hence the bird is highly useful.

Four to six white eggs are laid in a nest composed of moss, a few leaves and stems. The markings are of lilac and various shades of red clustered at the larger end.

639. WORM-EATING WARBLER. 5.5 in.

The Worm-eating Warbler is a comparatively common bird throughout the eastern United States, breeding in Pennsylvania, Ohio and some of the New England states. These retiring birds have a song resembling that of our common chipping sparrow. The males have an olive-buffy line over either eye and a third through the center of the crown, making the best field mark.

641. BLUE-WINGED WARBLER. 4.8 in.

The Blue-winged Warbler is a common bird in the eastern United States, breeding from Connecticut to Minnesota. It inhabits brushy places where we may expect to find the hooded and worm-eating warblers. The males are bright yellow beneath with a black line through the eye. The upper parts are bright olive green.

652. YELLOW WARBLER. *Dendroica æstiva æstiva*. 5.1 in.

The range of the Yellow Warbler is North America except the southwestern states; breeding north to the Arctic regions and wintering south to South America.

It is decidedly the commonest of the warbler family and is often called summer yellow bird, or wild canary. The latter name is entirely inappropriate and should refer to the goldfinch. The yellow warbler is less retiring in his habits than other birds of the family. It commonly nests about our dooryards, along public highways, in parks, in second growth timber, and in berry patches, and is an interesting and a highly useful bird. Probably no other bird is imposed upon so frequently by the cowbird as is this little warbler. Cowbirds frequently deposit their eggs in the nest of this warbler before the owner is ready to occupy her abode. As a result the parent frequently constructs another bottom to her nest, thereby disposing of the cowbird's egg. Larger birds are strong enough to throw the eggs of the cowbird to the ground. Sometimes the yellow warbler is obliged to construct three basements to her nest in order successfully to lay her own eggs and rear her brood without having to feed the young cowbirds.

The nests are very artistically built of Indian hemp, plant down, and sometimes sheep's wool. The lining is of willow down, cottonwood down, and feathers. The four or five eggs are laid about June 1st. The background is bluish white and the markings are of dark brown, often forming a wreath about the larger end.

658. CERULEAN WARBLER. *Dendroica cærulea*.
4.5 in.

The Cerulean Warbler, commonly called the blue warbler, inhabits the United States west to Nebraska and Minnesota, breeding from the states bordering the Great Lakes northward through New England, Quebec and Ontario and wintering in the tropics. This little warbler probably haunts the highest timber of any that frequents deciduous growth. It may be considered a rare summer resident in northern Illinois and Indiana.

Audubon describes the song as extremely sweet and mellow. The favorite call note is a dainty lisp, "Tweet-tweet-tweet-twee-ee," ending with a trill or twanging

effect on the ascending scale. These birds of the tree-tops are partial to elm and oak timber usually at the edge of the forest.

Like the chestnut-sided warblers these little fellows have a smart bantam-like appearance, carrying the tail rather high and moving nervously from twig to twig.

The nests are beautifully constructed and remind one of the abode of the blue-gray gnatcatcher. Externally they are made of grass and bark fibers bound with spider silk and lichens; the inside of the nest is composed of fine stems and grass. These little nests are firmly attached to the drooping limb of a tree from twenty-five to fifty feet above the ground. Four or five eggs are deposited.

659. CHESTNUT-SIDED WARBLER. *Dendroica pennsylvanica*. 5.1 in.

The Chestnut-sided Warbler is one of the commonest of eastern North American warblers, occurring chiefly west of the Mississippi River but in more southerly latitudes than most of our warblers, excepting the yellow and the black and white. The song of the chestnut-sided warbler is suggestive of the yellow warbler, and the two frequent similar growths of brush and woodland but in different localities. In central Ohio, northern New York and the New England states this bird summers in company with the prairie warbler. There are one or two nesting records for this bird in northern Illinois. It is an abundant summer resident in upper Minnesota, Wisconsin and Michigan. I found a number of nests during the first week of June around Butternut Lake, Wisconsin. The birds seem partial to berry bushes and small maples at the edge of woodlands.

The nests are loosely constructed of grass and coarse stems lined with finer material. The four or five eggs are laid about June 1st. They have a dull bluish white background and are spotted with shades of brown chiefly at the larger end.

660. BAY-BREASTED WARBLER. 5.6 in.

The Bay-Breasted Warbler is one of the handsomest of our wood warblers. The male has a cream-colored patch on the sides of the neck, the crown is chestnut, the throat, upper parts and sides are chestnut rufous. The birds spend the summers in the coniferous trees through Vermont, New Hampshire and Maine and northward into the Canadian provinces.

661. BLACK-POLL WARBLER. 5.6 in.

The Black-Poll Warbler is one of the last arrivals among our spring migrants. It is a large warbler, possessing a black crown and white ear coverts. The males have two white wing bars and the back and upper part is ashy streaked with black. The song resembles the hum of the katydid.

672. PALM WARBLER. 5.2 in.

The Palm and Yellow warblers are the earliest arrivals with the exception of the myrtle warbler. The palm, or red-poll, warbler is better known as a migrant in all parts of the continent, because it resorts to dense timber and nests on the ground in swampy places. A nervous bird, it moves through the underbrush, chirping distinctly and emphasizing each utterance with a jerking of the tail. Unlike most of our warblers, the plumage of the adult is the same in both sexes.

673. PRAIRIE WARBLER. *Dendroica discolor*. 4.8 in.

This little bird may be favorably compared with the common yellow warbler. It has, however, a much more restricted range, occurring in the New England and Atlantic states, rarely north of Connecticut or west of eastern Indiana and southern Michigan. It frequents low thickets of oak, hazel and briers. The song is rather weak and inconspicuous.

The birds breed abundantly in the vicinity of Washington, D. C. The nests are compactly built of vegetable

fibers and fine grass, lined with plant down and hair. Usually four eggs are deposited early in June.

674. OVEN BIRD. *Seiurus aurocapillus*. 6.2 in.

The Oven Bird, or Golden Crowned Thrush, ranges throughout eastern North America, breeding from Kansas and Virginia north to Manitoba and Labrador, south along mountains to South Carolina and wintering from Florida south.

The general outline of the oven bird is suggestive of the thrush family. Their name arises from their remarkable nest which is placed on the ground among the leaves, ferns, or fallen logs with the entrance on the side. The nest is covered externally with dead leaves interwoven with grass, and the lining is of fine round stems. Like the house of the ouzel, wren, and magpie, it is large for the size of the bird.

The oven bird is a common transient throughout Illinois, Indiana and Ohio, a few remaining to breed, while in Wisconsin and Michigan they are common summer residents.

Some authors describe the song of the male by saying it resembles the word "teacher" rapidly repeated eight or ten times in succession with greater emphasis on the last few notes. To the writer it always seems as if the little songster were trying to attract attention to himself by continually calling, "Me-sir, Me-sir, Me-sir."

The four to six eggs are white, profusely covered with spots of dark red. While walking over fallen logs watching a beautiful male Blackburnian warbler, I noticed a bird running through the leaves and moss with drooping wings as if greatly distressed. Its small size and striking appearance at once disclosed the identity of the bird and I carefully dropped to my knees and searched every square foot of ground until I discovered a little opening through which was displayed the handsomely spotted eggs of the oven bird. Had the parent remained upon her treasures her presence would never have been suspected.

676. LOUISIANA WATER-THRUSH. *Seiurus motacilla*. 6.3 in.

The range of the Louisiana Water-thrush is eastern United States north to the Great Lakes, wintering in the tropics.

"Amidst our more modest surroundings the Louisiana water-thrush occupies much the same position relatively that the water ouzel does in the mountainous regions of the West. Both birds possess themselves of the wildest environments to be had, and both are the animating spirits of their chosen haunts. Although no one suspects any structural affinities between the two, a half dozen other close points of resemblance might be noted, as poetic temperament and talent in song.

"Only the most picturesque and unfrequented glens are tenanted by this poet-bird from the south. Where cool waters trickle down from mossy ledges and pause in shallow pools to mirror the foliage of many trees will you find the water-thrush at home. Following an imperious chink of question and alarm, he will pause at the water's edge impatiently as though awaiting your withdrawal. The bird stands with the body horizontal or with the hinder parts elevated, jetting the tail vertically from time to time without moving the head. If you pretend to withdraw, the bird will wade about in the shallow water or search noisily among the dead leaves, uttering an energetic chink, or he tries hiding and disappears mysteriously behind a bunch of ferns. Three minutes elapse when the shrewd observer concludes there must be a nest and he moves forward, but the bird flies down the glen and no nest is found.

"Wherever the nest the bird regards himself as trustee of the whole glen, and his watchful fidelity is impartially bestowed upon all parts of it, as every half hour or so the male bird ranges its length. Now he dashes like a swallow across some open glade; now he pauses on a log or stone, alternately moving and inspecting until his voice is lost in the distance." (Adapted from Dawson's "Birds of Ohio.")

681a. WESTERN YELLOW-THROAT. *Geothlypis trichas occidentalis*. 5.3 in.

The Western Yellow-throat occurs from the Mississippi River to the Rocky Mountains, breeding north to Manitoba and wintering in Central America. In habits and general appearance he is very similar to the Maryland yellow-throat which occurs in the Mississippi valley, Great Lakes region and eastern United States north of the Ohio River. From California to British Columbia a sub-species known as the Pacific yellow-throat occurs; in southwestern United States another form called the Rio Grande yellow-throat is found, and we have the Florida yellow-throat in the southeastern portion of the United States.

No bird sings with greater vim and vigor than the yellow-throat. It haunts the rank grass and low shrubbery in wet places. The male may be heard calling, "whee-chee-chee," which is the writer's interpretation of the song. Some authors describe him as saying, "wichity, wichity." These birds destroy great numbers of worms and moths and their larvæ, so are highly useful to the interests of man.

The nests are placed in thick clumps of grass, sometimes in a low bush, well concealed by rank vegetation. Three to five creamy white eggs with dots and lines are laid.

685. WILSON'S WARBLER. 5 in.

Wilson's Warbler, one of our daintiest creatures, breeds from the Green Mountains of Vermont northward throughout the Canadian provinces from the Atlantic to Manitoba. The males have a yellow forehead, a black crown, and the rest of the upper parts, wings, and tail are bright olive green. These birds frequent the lower woodland growths usually in wet places. They are flycatching warblers with restless dispositions.

686. CANADIAN WARBLER. 5.6 in.

The Canadian Warbler is frequently known as the Canadian flycatching warbler. The breast is yellow,

vertically streaked with black so as to form a necklace across the breast. The writer found this bird breeding among the fallen logs and ferns in northern Wisconsin. The males are active about the nest and feed the female while she is incubating.

697. PIPIT. 6.4 in.

The Pipit, or Titlark, is our only true American Wag-tail. It is an inconspicuous bird and therefore overlooked by many observers. Only three of the sixty species of this family inhabit North America and but one is found in the Eastern States. They are terrestrial birds and have been named from their habit of wagging their tails. The tails are marked alike regardless of sex. The general appearance is suggestive of that of Smith's longspur or vesper sparrow.

22. THRASHERS AND WRENS.

Mocking-birds, Catbirds, and Thrashers are all described under the one sub-family, Mininæ. This group is distinctively American, about a dozen species reaching the United States. They are adepts at mimicry and are clever songsters, ranking first in execution. Their food consists of both animal and vegetable life. Thrashers and mocking-birds appear equally fond of grasshoppers and other insects and small fruits. Many birds of this family show a decided preference for the haunts of man, and are familiar in shrubby growths of populated districts. Most are decidedly warm weather birds.

Wrens, Sub-family Troglodytinæ, are mostly American and are most abundant in the tropics. These nervous, active birds inhabit thickets where they creep into all kinds of nooks and corners for their food, which consists of worms and insects and their larvæ. Most species are highly musical.

QUESTIONS.

Why do birds of this group not remain in cold climates throughout the winter? What birds of the group frequent the haunts of man? What ones may we attract by offering them homes? Which are increasing and which decreasing in number? Why is the catbird so called? Why is this a particularly useful group? Which is your favorite? Why? Why do you think the house wren more beneficial than the marsh wren? Why is Bewick's wren increasing in number while the house wren is decreasing?

703. MOCKING-BIRD. *Mimus polyglottos leucopterus*.
10.5 in.

The Mocking-bird is a member of the thrasher family and, like the cardinal, is gradually pushing his way northward and infringing upon the domains of the brown thrasher, often called our northern mocking-bird. While the mocking-bird is found chiefly south of the Ohio River, it is also found as far north as Iowa and central Illinois. The Rocky Mountain form is considered a sub-species, called the western mocking-bird.

Mocking-birds feed chiefly on worms, beetles, small berries, and fruit, so is a useful bird economically. By many sentimental writers rather than genuine naturalists, these birds are considered the finest of American songsters but, while they have a great range and quality of tone, our foremost authorities have not considered them in the same class with the wood and hermit thrushes, the bobolink, and the cardinal. Some admirers claim it should be made the National Songbird.

Neltje Blanchan writes: "With all his virtues it must be added that this charming bird is a sad tease. There is no sound whether made by bird or beast about him, that he cannot imitate so cleverly as to deceive every one but himself. Very rarely can you find a mocking-bird without intelligence and mischief enough to appreciate his ventriloquism—slim, neat, graceful, and

amusing with a rich, tender song and with an instinctive preference for the society of man."

Before the enforcement of the American Songbird Law, which prohibits the catching and keeping in confinement any of our native song birds, except by duly authorized parks and museums, this bird was a favorite pet. The young are easily reared by hand and many people prefer them to the canary. Mocking-birds are most at home near the habitations of man and are especially fond of perching on chimneys.

The nests are usually placed at low elevations and are bulky structures of grass, sod, and twigs, lined with dark roots, horse hair, and cotton. Like the catbird and the brown thrasher they enjoy placing their nests in the most impenetrable thickets. Four or five eggs are laid in May. The background varies in different specimens. Some are greenish blue and others tan. The markings are in the form of spots varying in shade from rich chestnut to pale brown.

704. CATBIRD. *Dumetella carolinensis*. 9 in.

The Catbird ranges throughout temperate North America, breeding from the Gulf to New Brunswick and British Columbia, and wintering in Florida and southward.

The catbird ranks high as a housekeeper, taking great pains in protecting her nest from the sun. Her plumage is a uniform slaty gray or a mouse color with a few reddish brown feathers on the under tail coverts; otherwise she possesses no suggestion of brown or rufous so prominent in the brown thrasher, a near relative.

The catbird shuns exposed situations. Though not a timid bird, often inhabiting the undergrowth in public parks or along pathways, both male and female are cautious in their movements, seldom exposing themselves except when flying from one cover to another. The brown thrasher gives vent to his feelings by singing from exposed perches, but the catbird, like the chat, talks

and sings in hidden places. Their alarm note, like their call note, sounds like the mew of a cat, hence the name "Catbird." The song proper is much like that of the brown thrasher. Catbirds feed upon worms and winged insects, which they find in the dense foliage, also upon berries and small fruit. Partial to warm weather, they do not arrive until the foliage in April is sufficiently developed to offer proper concealment.

"Reports from the Mississippi valley indicate that the catbird is sometimes a serious annoyance to fruit growers. The reason for such reports may possibly be found in the fact that on the prairies fruit-bearing shrubs, which afford so large a part of this bird's food, are absent. With the settlement of this region comes an extensive planting of orchards, vineyards, and small-fruit gardens, which furnish shelter and nesting sites for the catbird as well as for other species. There is, in consequence, a large increase in the numbers of the birds, but no corresponding gain in the supply of native fruits upon which they were accustomed to feed. Under these circumstances what is more natural than for the birds to turn to cultivated fruits for their food? The remedy is obvious; cultivated fruits may be protected by planting wild species which are preferred. Some experiments with catbirds show that the Russian mulberry is preferred to any cultivated fruit. Although the catbird sometimes does considerable harm by destroying small fruit, the bird can not be considered injurious. On the contrary, in most parts of the country it does far more good than harm." (Farmers' Bulletin, No. 54).

The birds are abundant in eastern North America where they frequently nest in the same shrub with the yellow warbler. The nests are quite bulky, being made of stems, leaves, and hay lined internally with dark rootlets. The nests may be found in low situations, usually not to exceed seven to eight feet above the ground. The four or five eggs are laid in May and a second brood hatches in July. The birds call vigorously when their nests are disturbed.

705. BROWN THRASHER. *Toxostoma rufum*. 11.4 in.

The Brown Thrasher ranges through eastern North America, breeding from the Gulf to Manitoba and Maine and wintering from Kentucky southward. This is the only bird bearing the name thrasher which occurs in eastern North America. From western Texas across to the Pacific several other thrashers occur. Arizona is the principal region for thrashers. There among the cacti and shrubbery one may find Leconte's, Palmer's, Bendire's, curve-billed and Cressal's thrashers.

The brown thrasher, commonly called brown thrush, is not a thrush but belongs to the same family as the mocking-bird and catbird. It is often properly called the northern mocking-bird and in the south is often known as the sandy mocker. It is a long slender bird with long tail, short wings, and curved bill. The upper parts are light brown; the throat and breast are thickly spotted and streaked with black. Less timid than the catbird, while he enjoys thickets, he unhesitatingly exposes himself, especially to sing.

The brown thrashers seem to be increasing in numbers and take more to the hedges in the fields. Some farmers complain of their crow-like fondness for corn; however, their fare of insects in the main makes them one of the farmer's best friends, though they do take toll of fruit.

Just at sundown I find myself among the hazel brush examining the tracks of some wary woodcock. Suddenly the air is filled with a series of trills, chirps, and warbles; now he whistles, now he sings, and presently he appears greatly agitated. This five-minute vaudeville announces the return of a most welcome resident. The brown thrasher hops about on the ground, taking great care in holding his long tail aloft and looking at all trespassers curiously through his lemon-colored eyes. A week or two later I find myself in the same place when I see through the brush among the leaves covering the soft mellow earth what I first thought to be a setting woodcock. It is none other than Madam Thrasher, who has constructed a nest of stems and grass containing four

light blue eggs densely covered with minute specks of brown. The lining of the nest is of rootlets, and so differs from the nest of the woodcock. Some nests are placed in brush piles, others in thorn-apple trees, easily within reach of the ground. The first nest is constructed late in April and the birds rear a second brood in June.

718. CAROLINA WREN. *Thryothorus ludovicianus ludovicianus*. 5.5 in.

The Carolina Wren is found about the Great Lakes region in limited numbers. Their true summer home is south of the central portions of Illinois and Indiana and south of Iowa to the Gulf and east to the Atlantic. In southern Illinois and Indiana they are abundant. They are resident except in the northern limit of their range. This largest eastern wren nests about dwellings, sheds, brush, fence corners and fallen logs. They remain paired throughout the year and are endowed with happy dispositions, singing almost constantly from early February until early fall.

They are musical and sing wherever found. Of their several songs, the common call or alarm note may be described thus, "Kurs——t," "Whe-o-wow-whe-o-wow-whe-o-wow" or "Ju-piter, Ju-piter, Ju-piter, Ju-piter," may give some idea of the elements of its best known song. In tone and quality the notes remind one of the song of the Maryland yellow-throat. His loudest notes suggest the whistling of the cardinal.

The food of this useful bird consists chiefly of insects and spiders. They hop about old logs, stumps and debris, intent in their pursuit of food. Mr. E. R. Quick, a resident of Indiana, describes a pair of Carolina wrens that frequented his premises a few winters ago and became very tame. In January he was splitting some honey locust logs and the wrens, which sat within three feet of him, would hop down among the sticks when they were split and pick out the larvæ.

Mr. E. R. Ford, of Chicago, discovered a pair breeding in Cook County, Illinois. The nest was placed in

the hollow of a tree near the ground. The birds usually carry a quantity of grass, straw, moss and leaves into a cavity and late in April or during early May four to six white eggs are laid, spotted about the larger end with pale red and brown.

719. BEWICK'S WREN. *Thryothorus bewicki bewicki*. 5 in.

This bird is frequently described as the long-tailed house wren. It is slightly smaller than the Carolina wren and larger than our common house wren. There are many sub-species but the true Bewick's wren inhabits eastern North America from Texas and Georgia rarely as far north as the Great Lakes region. Along the Atlantic Coast it is of only casual occurrence. It winters in the Gulf States. Like the house wren it exhibits a preference for populated sections, frequently spending the summer about a large residence, nesting in the vines, woodpile, or places that would appeal to the little house wren. The range is extending farther north.

Mr. John Wright of Bartholomew County, Indiana, observed a pair that nested on an old mantel in a deserted house for three consecutive years. The first two years they built in a tin can, but the third year the tin can was missing so they built right on the mantel. Mr. E. R. Quick, another Indiana observer, records a pair that reared a number of broods in a gourd. Once the same pair of birds, after hatching the first brood, brought forth a second brood from a nest in a ball of twine lying in a binder.

Their song is finer in tone than that of the Carolina wren. The alarm note is a distinct little "plit." Among our finest singers, they possess several songs, loud and penetrating.

The birds are great insect destroyers and they are doubly beneficial because of the number of young reared in a season. Bewick's wren is on the increase, doubtless because it is able to withstand the saucy English sparrow.

The nests are made of the usual wren material which is an accumulation of twigs, grass and feathers. The eggs are white, minutely speckled with brown.

721. HOUSE WREN. *Troglodytes ædon ædon.* 5 in.

The House Wren ranges throughout eastern North America, breeding to Manitoba and Ontario, and wintering in the Gulf States.

This is little "Jenny Wren" whose tail sticks up like a "sore thumb." Some authors have considered western Indiana as the western limits of our common house wren, thereby classifying the species which occurs about Chicago as the western house wren. From observations which I have made in the Great Lakes region, I am of the opinion that the distinction is not perceptible until we go west of the Mississippi. In the territory between the Mississippi and the Rocky Mountains, the birds have a somewhat different song and their plumage is slightly lighter. On the Pacific Coast a still lighter form exists known as Parkman's wren. The wrens partake of the habits of both the thrashers and creepers. The house wren frequents barns and gardens and particularly old orchards. The food consists almost exclusively of insects, including grasshoppers, beetles, caterpillars, and bugs. These little birds often select unusual nesting sites, such as an old coat in the barn, brush heaps, tin cans, hitching posts, abandoned woodpecker excavations, and bird houses constructed for the purpose. The nests are remarkably large for the size of the bird, and I have never seen one that could be removed intact without disturbing the surroundings. Children should be encouraged to put up nesting boxes for these useful birds. A tin can with a hole too small to accommodate a sparrow, and no stoop in front, is sufficient.

The male sings at half hour intervals throughout the day, from the time he arrives in the Middle States late in April until well along into July. Old stump fences which are used in some farming sections afford inviting

breeding sites. Numbers of wrens may be found breeding about fields which are enclosed with this crude sort of fence.

I have seen the little fellows carry twigs eight inches long endwise into holes not exceeding an inch in diameter. One or two nests I have seen closely embedded in a thick cluster of vines. The nests are lined with feathers, hair and grass. From six to nine eggs are laid and two broods are reared in a season.

722. WINTER WREN. *Tannus hiemalis hiemalis*.
4 in.

A trifle smaller than our house wren, the little Winter Wren is found in Illinois, Indiana, and Ohio only during the late spring and early fall. It is not a conspicuous bird while migrating because it spends all the time about fallen logs, old stumps and brush piles. It often does not fly until one is almost upon it. The only note as a migrant is a decisive little chatter, but it sings sweetly in its summer home. The winter wren summers from the northern borders of Maine, New Hampshire, Vermont, and possibly Michigan and Wisconsin, northward; it winters from New Jersey and southern Illinois southward.

Like the water thrush and dipper, nothing is more inviting than the roots of an upturned tree. Sometimes the crevices of unoccupied buildings or woodpiles are used to shelter the nest, which is composed of small twigs, moss and leaves, compactly interwoven and warmly lined with the feathers of various wild birds. The birds will desert the nest if it is touched by human hands.

The four to six white eggs, laid during the latter part of May or early June, are minutely and sparsely speckled with purple and lavender chiefly at the larger end.

724. SHORT-BILLED MARSH WREN. *Cistothorus stellaris*. 4 in.

The Short-billed Marsh Wren ranges throughout eastern North America, breeding from Manitoba to

Massachusetts and south and wintering in the Gulf States and Mexico.

In June when the waters of the marshes and sloughs have evaporated, the grass often becomes four or five feet high where the little "short-billed" forages. In general appearance he reminds us of his neighbor, the long-billed marsh wren, but is darker in plumage and may be identified by his song, which is entirely different although expressing the genuine wren gurgle. The wrens sing as if they had some liquid in their throats and were attempting to gargle. Rushes and cattails have no particular attraction for the short-billed wren. He may choose a small scrub willow as a suitable place to pour forth his notes to the female, skulking in the grass. Like all other wrens the short-billed is a useful bird economically because of insects destroyed.

In summer, when mosquitoes are aggravating, the bird lover does not travel these tangles with the same enthusiasm as in April and June when the pests are fewer and progress more easy. Still we long to know more about the home life of the short-billed wren and the song of the male assures us that we will be rewarded if persistent in our efforts. Perhaps it has not rained for many days and the grass is dusty from pollen and plant down. I drop to my knees and move slowly through the grass, looking carefully in all directions before advancing. Eventually a little bird flies slowly from the cover ahead and takes refuge behind a little willow. Moving in that direction I discover a round ball composed of long grass or hay neatly woven to the green stems with a little opening on the side. Carefully inserting my finger I find the interior incomplete. This nest will remain so. I mark the nest and soon discover another grassy bulb which is uninhabited. There appears to be only one pair of birds in the immediate vicinity so I have discovered two sham nests. There are probably one or more additional structures, but one only contains the pure white eggs. I now examine the nest which is externally the least attractive, only to find it warmly lined with cat-

tail down on which are deposited seven eggs. Crouching low in the grass, I await a visit from the birds, and presently both of them are preoccupied about the vacant nests. What intelligent little fellows they are to seek in this manner to conceal their treasures.

725. LONG-BILLED MARSH WREN. *Telmatodytes palustris palustris*. 5.2 in.

The Long-billed Marsh Wren ranges throughout eastern North America, breeding from the Gulf to Manitoba and east to Massachusetts, and wintering from the southern states into Mexico.

The long-billed marsh wren has been subdivided, though very little difference exists in their general song and habits. The type inhabiting the central United States and upper Mississippi valley is called the prairie long-billed marsh wren. East in the United States and Canada is the summer home of the long-billed marsh wren, the true form. Swamps and sloughs, where cattails and bulrushes grow luxuriantly either in fresh or stagnant water, is an attractive place for these little creepers.

The song is a rather hoarse, rollicking warble, suggestive of one with a chronic case of bronchitis, continued whether the bird is at rest or in the air.

The food is insectivorous and therefore these little birds are of great value to mankind although they do not haunt the cultivated sections.

From three to seven nests are built, only one of which is entirely completed and used. From external appearances one might expect all of them to be occupied. Whether these extra nests are built merely for recreation, or for the intention of deceiving their enemies, is a question open for debate.

The nests are globular with an entrance at the side. Externally they are composed of dead rushes, grass, moss and a liberal amount of cattail down used as a lining. From four to eight chocolate brown eggs are laid and the young hatch in about ten days.

23. CREEPERS.

Kinglets, Chickadees, Verdins, Nuthatches, Gnatcatchers, Titmice and Creepers all search for insects about trees, particularly along the trunks. Others hop nimbly from branch to branch, catching insects in the air.

The brown creeper is the only true form inhabiting North America. It has stiffened tail feathers which it uses as a prop, as do woodpeckers.

Nuthatches are more adept at climbing, as they move along the branches and down tree trunks head first, a feat which creepers and woodpeckers do not attempt. Titmice, or chickadees, and nuthatches are resident the year round in a given locality. They belong to different sub-families.

The family Paridæ comprise the two sub-families, Sittinæ or nuthatches and Parinæ or chickadees. Four of the twenty species of nuthatches are American. All are climbers but they climb downward, head first, as well as upward. They do not use the tail as a prop. The name comes from their method of placing nuts in crevices and hacking or hatching them by pounding with the bill while head hangs downward. Thirteen species of chickadees are found in North America. Chickadees seem poorly fitted to cope with our severe winters, having weak bills and being largely insectivorous. Both nuthatches and chickadees are somewhat migratory at northern limit of their range, but are usually resident where found.

Kinglets and gnatcatchers are our smallest American birds with the exception of the humming-bird. Our most common American forms are the ruby and golden-crowned kinglets, blue-gray gnatcatchers, and verdin. They are active little birds, flitting about in search of insect food. Kinglets are partial to coniferous trees during the breeding season. While kinglets and chickadees seldom attach themselves to the tree trunks they may often be seen hanging downward at the extreme end of a branch.

QUESTIONS.

What of size of birds of this group? Why are some of them winter residents? Since both feed on insect life, why must the warblers migrate while so many birds of this group remain throughout the winter? Account for the various names of these birds; as kinglet, chickadee, nuthatch, gnatcatcher, creeper. Contrast mode of locomotion of the brown creeper and the nuthatches. Do you think these birds structurally closely related to the woodpeckers? What two notes of the chickadee? Why feed chickadees and nuthatches in winter? Are chickadees well adapted to our northern winters? What advantage over them have woodpeckers? What advantage over them have sparrows? Why does the chickadee fluff out its feathers? What is its sleeping place and what its advantage? What of protective resemblance of the brown creeper? What three winter residents are frequently found together?

726. BROWN CREEPER. *Certhia familiaris americana*. 5.7 in.

The Brown Creepers summer from Maine to Montana and northward to the fur countries. Occasionally they appear in the mountainous parts of Pennsylvania and New York and they have always been observed nesting in the river bottoms near St. Louis, Missouri. They winter in southern United States generally.

The shape of the bill is like that of our wrens, which enables the birds to extract from the inner crevices of the bark various insects and their larvæ and eggs, thus making them of great economical value to the horticulturist. They do not attempt to excavate or burrow into the softest wood but usually confine themselves to living trees covered with rough bark. The tail is long and the feathers are stiff and pointed, as it is used for support. He does not progress after the manner of the kinglets or nuthatches, but throws his head back and hops upward by moving both feet in unison.

The nests are an accumulation of bark strips, grass,

and feathers snugly tucked away under the loose bark on the perpendicular trunk of a tree, which may be standing on the edge of a dense woods or near a little lake.

The eggs are pure pearly white, thickly dotted about the larger end with bright reddish specks.

727. WHITE-BREASTED NUTHATCH. *Sitta carolinensis carolinensis*. 6 in.

The White-breasted Nuthatch is a resident of eastern North America from Canada to the southern States, breeding throughout the range.

Nuthatches are equally good at climbing or creeping. They are the only American birds which attempt to travel any distance down the trunk of a tree or the underside of a limb, head downward. They do not brace themselves with the tail as do the woodpeckers and creepers. They are hardy birds spending twelve months of the year in a good locality. During the coldest weather they wander through the trees of our parks and orchards in company with the chickadees and downy woodpeckers. Like the latter they have been improperly called sapsucker.

The birds are very handsomely colored with bluish gray above excepting the crown of the head which is black. The breast is white. The call is a nasal note reminding one of the quack of a female duck.

Probably few birds are more beneficial to the fruit grower because of their feeding habits throughout the year. They destroy insects and their eggs obtained from crevices in the bark and from the under side of green leaves. They may be attracted about homes and orchards by putting suet out for them, and so set these industrious birds at their winter task of destroying insects and their eggs where such service avails most.

A knothole in a living tree is a favorite nesting site. Sometimes, however, the birds accept the deserted excavation of a downy woodpecker. Feathers, hair, and dry leaves are crowded into the cavity and in April from four to nine eggs are laid. They are pure white and handsomely spotted with lilac and reddish brown.

728. RED-BREASTED NUTHATCH. *Sitta canadensis*. 4.6 in.

The Red-breasted Nuthatch is migratory in the Great Lakes region, passing the summer months from northern Maine to southern Manitoba, thence northward into the timbered regions of Canada. In the Alleghanies and in western United States they have occasionally been found breeding in the mountainous regions at an altitude which would correspond to our Canadian climate. They winter from about southern breeding range south.

It is interesting to watch this nuthatch constructing a little cavity for a nesting site usually in a white birch or poplar stub. Mr. Manly Hardy, who studied the habits of this bird in Maine, writes that in making the entrance to the nesting cavity proper, the birds perforate the bark in a circle with smaller holes and then take out the center piece. A strange fact concerning the nests found by Mr. Hardy and others is that the bark at the entrance is coated with fir balsam or pitch from an inch to four inches around the hole. In one instance the pitch extended down for twenty-one inches and was stuck full of the red breast feathers of the nuthatches. The nesting cavities are about four inches in depth.

Four to six white eggs thickly spotted with reddish brown are laid on a little nest of fine grass.

731. TUFTED TITMOUSE. *Parolophus bicolor*. 6 in.

The Tufted Titmouse ranges throughout eastern United States, breeding from the Gulf to southern Iowa and New Jersey, and is resident throughout the breeding range.

Richard C. Harlow writes of tufted titmice: "The course of streams seems in a large measure to determine their distribution, as they are usually to be found in the vicinity of water.

"Apparently the coldest winter has no effect on them, as they seem just as contented among the February

snows as in the May sunshine. In the winter they may frequently be noticed in company with nuthatches and downy woodpeckers for whose society they show a pronounced liking. Like these birds, too, the titmice are of great economic value as food of all these species is insectivorous. Titmice are usually found in pairs and are, I believe, mated throughout the year. The tufted tit is one of our few birds on whose voice the winds of winter seem to have no effect. Their loud, pleasing whistle may be heard at all seasons, especially in the early spring. It is interesting to note that the female tit can sing as well as the male. The tufted titmouse has four distinct notes, the one usually heard being the whistle already referred to, a loud clear, 'peto, peto, peto,' the note being repeated from three to seven times, usually four or five. This is occasionally varied but the intonation is essentially the same. Another note frequently heard is a 'sic-a-dee,' something like that of the chickadee, though noticeably louder. They also have a third, a low-murmured, 'dee-dee-dee,' which I have only heard at the nest or in the near vicinity of the same. The last, but not least, use to which their vocal chords are put is a distinct, snake-like hiss uttered by the female when the nest is threatened.

"I was attracted by a low, peculiar 'dee, dee' quite different from any note I had previously heard. In a moment I had traced the sound to a tit at the entrance to its nest. A large catalpa tree leaned over the creek at this point at an angle of 45 degrees, and up about fifteen feet, directly over the water and on the upper side of the trunk was a knothole. The bird was at the entrance to this and in the act of placing some morsel in the bill of his mate within. In a moment I was on my way up the trunk with my eyes glued to the hole. Each moment I expected the female to leave, but in this I underestimated her courage. Looking within I was greeted with her peculiar hiss, but as she sat close and I was unable to insert my hand in the small cavity, the contents were a mystery. Ten minutes later I had suc-

ceeded in borrowing a hatchet from the shanty of a gentleman of color and was again at the tree. The cavity was soon enlarged and I inserted my hand. On seeing my hand, however, she concluded that it was time to act and she went at me bill and claws. I was hoping for a set of eggs, but imagine my disappointment when I finally discovered the contents to be one newly hatched bird, six hatching eggs and an infertile one, which I took and left the anxious birds in possession of their home. I paid several visits to the place after this and learned that the young of these useful birds were fed to a large extent on larvæ. They left the nest just eleven days after the eggs were hatched."

735. CHICKADEE. *Penthestes atricapillus atricapillus*.
5.25 in.

The Chickadee ranges throughout eastern North America, breeding from southern Illinois and Pennsylvania, and south along the mountains, northward. Though usually resident the year around where found, in winter it migrates a short distance below the southern limits of its breeding range.

It is a very bold and interesting little fellow. When the snow is on the ground and the timber land is almost void of bird life, a small band of chickadees may be seen moving freely through the undergrowth, usually accompanied by one or two woodpeckers and perhaps a white-breasted nuthatch. These birds during cold days will eat from the hand without hesitation. Many bird lovers attract them to their dooryards by placing bread crumbs and grain on the doorsill, also by hanging up beef suet.

Originally the chickadees subsisted almost entirely upon minute forms of animal life, but in recent years they have become quite omnivorous and take readily to the finer grains and berries. The birds are of great importance to the horticulturist as they take from the cracks of the bark countless numbers of insects and their

larvæ and eggs. While they may not reach the orchard and shade trees until after the breeding season, they are diligent and get in their work when they do arrive. Like the kinglets, chickadees are true acrobats and move from limb to limb head down with almost as much ease as the true creepers which are the nuthatches.

The timber along river bottoms or old stumps on the edges of clearings are favorite nesting sites. Sometimes the nest is constructed in a natural cavity but usually an abandoned woodpecker's hole is warmly lined with hair and feathers. In this six to ten white eggs heavily speckled with rich reddish brown are laid. Nest building begins early in May and the young hatch in ten days. Both parents assist in the duties of incubation and in caring for the young. It is estimated that a pair of chickadees average 275 trips a day in caring for their brood.

746. VERDIN. *Auriparus flaviceps flaviceps*. 3.8 in.

The Verdin, or Yellow-headed Bush-tit, is one of the smallest American birds. His general appearance and habits remind one of our kinglets. The verdin, however, inhabits the southwestern portions of the United States from western Texas across the arid regions of New Mexico and Arizona through lower California. This tiny creature with his bright yellow head measures smaller than our largest American humming-bird.

Like our magpie and wrens he constructs an immense nest. Thorny twigs and stems are cleverly interwoven into a nest resembling in size and shape an ordinary cocoanut. A little entrance is made at the side and into this the birds carry flower stems and feathers. Low branches in brier-like trees and shrubs are favorite nesting sites. Sometimes the birds nest among the cacti. The nests are securely fastened in a small cluster of twigs or thorns. The eggs are light blue daintily covered with minute specks of pale brown.

748. GOLDEN-CROWNED KINGLET. *Regulus satrapa*. 4.1 in.

Aside from the Ruby-throated Humming-bird the Kinglets are the smallest of eastern North American birds. They are hardy little creatures, many of them wintering in southern Illinois and adjacent states. Their summer home is chiefly in the northern portions of the Northern states from Maine west to and including Minnesota, northward. In Montana, Oregon, and Washington the western golden-crowned kinglet occurs. Kinglets winter generally throughout the United States except in the northern tier of states. The habits of the two species are practically the same.

These useful birds while migrating frequent highways, dooryards, and public parks in great numbers. They move about apparently unconscious of man, feeding among the lower branches and occasionally darting into the air for an insect. In feeding in patches of burdock many golden crowned kinglets become fatally entangled in the burs. Sometimes an entire flock of six or eight meet death in the space of a few rods.

The summer home of the kinglets is infested with countless millions of insects. So abundant are these various forms of minute insect life that mosquito-proof clothing must be used. Even fur-bearing animals are unable to endure the pests which are at their worst in May, gradually diminishing as the surface water evaporates. Upon their arrival in the northern United States, the kinglets immediately resort to the coniferous groves. The males sing from the densest balsams and hemlocks where one would expect nothing smaller than a robin to utter such an outburst of melody.

The nests are beautiful structures built of moss, lichens and sometimes plant down. The lining consists of hair and feathers. The nests are securely fastened to the small stems on the drooping boughs of an evergreen. Owing to the dense woods in which these birds nest and the rapidity with which they move through the

coniferous trees, the nests are rarely discovered except by watching the birds carry nesting material.

749. RUBY-CROWNED KINGLET. *Regulus calendula calendula*. 4.4 in.

The Ruby-crowned Kinglets travel northward through the Central United States from the Atlantic to the Pacific. They nest in cold climates, usually in Canada, though frequently the mountains of Colorado and the Pacific Coast, with their growths of fir and hemlock, offer inviting sites. They winter south of the southern limit of breeding range.

The ruby-crowned may be distinguished from the golden-crowned by the crimson patch of feathers extending back from the base of the bill on the male birds, while the golden-crowned has orange or yellow on the top of the head. These little fellows are less common than the golden-crowned and migrate singly or in groups of two or three. They do not seem to be attracted to the seeds of the burdock and so escape the cruel fate of the golden-crowned which often becomes fatally entangled in the burs of the dock.

The song of the ruby-crowned is sweet and remarkable in volume for so small a bird. People of the Central States are rarely favored with the song of the golden-crowned but the ruby-crowned sings during the spring migration. His melodious little ditty is apparently poured forth simply because he is happy and not for the benefit of his sober mate for she is not in evidence.

The nests are beautiful little globular affairs constructed of moss and lined with the feathers of wild birds. They are securely fastened among the smaller branches usually of a coniferous tree, and the nest is sometimes found with the entrance at the top, but generally the entire structure is fastened to the twigs beneath the main branch and near the extremity of the limb.

The nests are difficult to locate unless one is fortunate in contending with the millions of mosquitoes and other insect pests which inhabit the timbered lakes in April

and May when nest building is in progress. A quantity of pennyroyal rubbed on hands and face will serve partially to protect the naturalist from these tormenting insects. Nothing is more to the liking of the kinglet than these minute gnats. They also devour other insects and their eggs and larvæ.

I have six tiny eggs of the ruby-crowned kinglet sent me from Colorado.

751. BLUE-GRAY GNATCATCHER. *Polioptila carulea carulea*. 4.5 in.

This dainty little bird frequents the upper branches of trees where its presence is not often suspected. The note is weak and suggests the distant call of a catbird. These little birds inhabit the United States, particularly south of latitude 42 degrees. Georgia, Tennessee, the Carolinas and Ohio are favorite states for this little gnatcatcher during the summer months. A few nest as far north and west as upper Illinois and Indiana. In southern and eastern Michigan it is found in suitable localities where second growth oak, elm and hickory are found. The white outer tail feathers and small size are unmistakable field marks.

These interesting little birds seem to have a spirit of adventure in pursuit of food. They have been seen entering a long small water pipe used as a hitching-rack for horses and would traverse the entire distance emerging from the other end.

The nest of the blue-gray gnatcatcher is one of the marvels in bird architecture. Externally covered with lichens held in place by cobwebs, it is securely saddled on a horizontal limb eighteen to forty feet above the ground. On the inside the nest is warmly lined with plant down, and from below one can scarcely distinguish the nest from a knot on the limb. It looks much like the nest of a humming-bird.

The four or five greenish eggs are daintily speckled with dark brown. In Ohio and southern Michigan nest building commences about May 15th, and the eggs

are deposited late in May or early in June. The period of incubation is about ten days.

24. THRUSHES.

Thrushes and Dippers are unquestionably the sweetest voiced birds in America though inferior to some other songsters in execution. These birds are all migratory, returning regularly to a given locality in April or May to breed. They live upon worms, winged insects, berries, and fruit. They are not sociable while nesting but migrate in flocks and are usually gregarious also in winter. Their bodies are cylindrical. The plumage on the upper parts is usually a uniform color of blue, brown, or gray.

"On the basis of certain details of structure thrushes are generally assigned highest rank in the class of Aves. Without pausing to discuss the value of the characters on which this classification is made, there can be no question that from an æsthetic standpoint the thrushes possess in a greater degree than any other birds those qualifications which make the ideal bird. There are many birds with brighter plumage, more striking voices, and more interesting habits, but there are none whose bearing is more distinguished, whose songs are more spiritual. The brilliant humming-birds and tanagers excite our admiration, but the gentle, retiring thrushes appeal to our higher emotions; their music gives voice to our noblest inspirations.

"Five of the true thrushes of the genus *Turdus* are found in eastern North America. Three of them may be mentioned here—the veery, wood thrush, and hermit thrush—a peerless trio of songsters. The veery's mysterious voice vibrates through the air in pulsating circles of song, like the strains of an Æolian harp. The wood thrush's notes are ringing and bell-like; he sounds the matin and vesper chimes of day, while the hermit's hymn echoes through the woods like the swelling tones of an organ in some vast cathedral." (Chapman.)

QUESTIONS.

Which is your favorite bird of this group? For which should you prepare a nesting box? Which is your favorite songster? As you cannot have both which do you prefer, the family cat or such friends as these birds? Why the name dipper? By what other name is it known? What other land birds now obtain food about the water as do the dippers? Tell of them.

701. DIPPER. *Cinclus mexicanus unicolor*.

Mountainous portions of western North America from the northern portions of Central America northward to Alaska are frequented by the dipper, or water ouzel. While these bluish gray birds are considered to be closely related to the thrushes, they show little family resemblance except that they are exceptionally sweet songsters. Aquatic as the mud hen, they run nimbly over the rocks and stones after the manner of our little spotted sandpiper, tilting backward and forward. In some ways their habits are suggestive of our water thrushes, as these nervous birds are constantly on the move. They are never found about stagnant water, but frequent the mountain torrents where the water dashes over the rocks. Here they seek small forms of animal life among the crevices.

One naturalist describes the bird as follows: "They are the embodiment of a mountain torrent—bustling and energetic; and their song is like crystallized spray, sweet, sparkling, and vivacious; taken with its surroundings. I do not know of any other bird's song which surpasses it."

The beautiful nests are placed on a little ledge or shelf usually close to the water's edge where they are frequently kept damp by the spray. Sometimes the roots of an upturned tree afford a suitable site. The nest is a beautiful ball of green moss, dome-shaped with a small entrance at the side. It is strongly arched over with leaves and grasses and supported by twigs, the wire mass being

firmly cemented with mud. It is hardly possible to secure one of these nests for museum purposes because of their peculiar composition and the firmness with which they are attached to other articles. Four or five pure white eggs are laid. The latter half of May and the first two weeks of June are the breeding dates. The eggs bear a general resemblance to those of the purple martin. I have a set of four sent me from the mountains of Colorado.

755. WOOD THRUSH. *Hylocichla mustelina*. 8.3 in.

The Wood Thrush, or Song Thrush, is quite a local bird, being partial to certain localities. It occurs at frequent intervals from the Atlantic to the Mississippi, breeding from the Ohio River into southern Canada and wintering in Central America.

The head, back, tail and upper wing feathers are rich olive brown. The breast and lower abdomen is whitish, distinctly spotted with black, giving the bird a handsome polka-dot effect, the most striking field mark.

Commonest of our thrushes, except the robin and bluebird, in size he ranks next to the robin, but is less boisterous and not so familiar. Like the olive-backed and hermit thrushes the wood thrush is retiring and solitary in his habits.

In the estimation of many bird lovers, it ranks first as a songster. The clear, liquid, metallic notes may be heard after sunset, coming from the dense portions of our wooded districts or from shaded lawns of villages. A mile from the author, separated by an expanse of water, I have often enjoyed the clear, bell-like notes which here vibrate more exquisitely than elsewhere.

They feed usually on the ground, where the rich soil offers little resistance to their short, slender bills. Insects, berries, wild fruits, and soft vegetables, such as an overripe tomato, will often prove tempting morsels. Low, damp woods, heavily timbered roadsides, and underbrush along streams are chosen haunts. The haunts seem to be changing from dense woods to towns and about

farmhouses, as the primeval forest disappears and the trees grow up about residences.

The nests are placed from four to thirty feet above ground, usually in a dense shrub or vine, often about houses. In construction they are similar to the robin's nest. Roots, stems and grass enter into the composition and these are held in place and cemented to the branches with a moderate amount of mud. The inside of the nest is lined with grass and roots. Three or four deep blue eggs, usually darker than a robin's, are laid. When sitting the mother bird is very tame and does not offer the aggressiveness of the robin when molested.

756. VEERY. *Hylocichla fuscescens fuscescens*. 7.5 in.

The Veery, formerly called Wilson's Thrush, is a common bird in eastern North America west to Illinois and Wisconsin where its near relative, the willow thrush, occurs. The veery winters in Central America. Wilson's thrush is a smaller and lighter form of the true willow thrush but the habits, song, and disposition are identical. This bird loves the deep shady groves where fallen logs occur. Like most other thrushes, the veery and the willow thrush are celebrated songsters, though, owing to their modest ways, they are more often heard than seen. "The veery has a double personality, or he may repeat the notes of some less vocally developed ancestor, for on occasion he gives utterance to an entirely uncharacteristic series of cackling notes and even mounts high in the tree to sing a hesitating medley of the same unmusical 'cacks,' broken whistled calls, and attempted trills. Fortunately this performance is comparatively uncommon and to most of us the veery is known only by his own strange, unearthly song. His notes touch chords which no other bird's song reaches. The water thrush is inspiring, the wood and hermit thrushes 'serenely exalt the spirit,' but the veery appeals to even higher feelings; all the wondrous mysteries of the woods find a voice in his song; he thrills us with emotions we cannot express." (Chapman.)

Late in June, 1911, I had the pleasure of finding several pairs of willow thrushes occupying a little stretch of woodland in northern Illinois. My attention was first attracted by an extremely sweet note full and low, but decidedly softer than the song of the wood thrush. My search revealed two nests, one on the ground at the base of a bush and the other a beautiful nest of bark strips, stems and moss placed on a fallen bough three feet from the ground and concealed by overhanging ferns and vines. The latter contained four deep blue eggs. This is probably the most southern record for the willow thrush. Minnesota and the provinces of Canada is the summer home of this retiring bird.

758a. OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni*. 7.2 in.

From the northern United States northward the Olive-backed, or Swainson's, thrush is common during the summer months in some localities. Nova Scotia and New Brunswick are favorite retreats of this forest-loving bird. In most of the United States east of the Rocky Mountains these birds are with us only as transients. They appear in April on their way north, and again for a week or two in October on their way to the northern part of South America where most of them spend the winter.

Like the robin this bird loves to glean its food from rich soil. During the migrations it frequents the door-yards and unfortunately ventures too near the haunts of lurking felines. The song is soft yet penetrating. Late in the afternoon or early evening when all about the woodland marshes is tranquil, I have listened to the vibrating notes of the olive-backed. The effect of its loud and beautiful song is enhanced by the evening hush. "It lacks the leisurely sweetness of the hermit thrush's outpourings, nor is there pause, but in lower key and with greater energy it bubbles on rapidly to a close rather than fading out with the soft melody of its renowned rival. There are also a variety of other notes." (J. Dwight, Jr.)

The nests are placed in both coniferous and deciduous trees usually not more than six or eight feet high. I found several in the vicinity of Butternut Lake, Wisconsin. In general structure the nests were very similar to the robin's, but smaller to correspond with size of the bird. The three or four eggs are deep blue, beautifully dotted with deep brown and chestnut. Nest building begins early in June and before the month is over most of the young have hatched.

759b. HERMIT THRUSH. *Hylocichla guttata pallasi*.
7.17 in.

The Hermit Thrush ranges through eastern North America, breeding from northern Michigan and Massachusetts northward, and southward along the Alleghanies to Pennsylvania, and wintering from southern Illinois and New Jersey to the Gulf States.

"In the Canadian fauna the hermit thrush, the most definite thrush to study, comes a month before the olive-backed thrush arrives, while the snow wraiths still linger in the shadowy forests. In the fall it tarries as long after the olive-backed has departed.

"When the hermit thrush appears in the spring its song is wonderfully sweet, but it does not come into full possession of its voice until some time after its arrival. It is usually conceded to be our most beautiful singer. In early August, it is still in full song, but by the middle of the month the song is thin, suggesting the imperfect attempts of a young bird. Later than that it seldom sings.

"It is to be regretted that so many of the young fail to mature. A record kept for five years, containing the history of fourteen nests and forty-seven eggs, shows that only nineteen fledgelings left the nest. I wish to emphasize the fact that these very beautiful, insectivorous birds lead a most precarious existence, having to contend not only with wild foes but with domestic cats.

"In two or three cases, I have found the hermit thrush very timid. Generally, the bird flies from the

nest as a person approaches, or run away over the leaves with head and tail drawn down to appear less conspicuous, mounts a branch at a safe distance, slowly raises and lowers its tail, then glides from sight. One or two have been so tame that I have had to put my hand out as if to touch them, in order to drive them from the nest." (Cordelia J. Stanwood.)

"Sometimes it sings during the winter in Florida, and also while migrating; but if you would hear this inspired songster at his best, you must visit him in his summer home. The hermit's song resembles that of the wood thrush in form, but it is more tender and serene. 'O spheral, spheral! O holy, holy!' Mr. Burroughs writes as its opening notes, and there is something about the words which seems to express the spirit of heavenly peace with which the bird's song is imbued." (Chapman.)

The nest of moss, coarse grass and leaves, lined with pine needles and rootlets, is placed on the ground generally under a low fir tree. Three or four greenish blue eggs are laid.

761. ROBIN. *Planesticus migratorius migratorius*. 10 in.

The range of the Robin is eastern North America to the Rocky Mountains, breeding from the northern part of the Gulf States to the Arctic Ocean, and wintering from Illinois and New Jersey southward. From the Rocky Mountains westward a paler plumaged bird, called the western robin, is found with habits similar to those of the robin east of the Great Plains.

Robins join us north of the Ohio early in March, immediately announcing their presence by warbling gently, perhaps in the immediate vicinity of their last year's nest. The migrating robins which go north of us to spend the summer are not so partial to habited sections until they reach their destination, and are more apt to be found in small flocks in wooded pastures, parks, or underbrush.

The robin feeds largely upon earth worms, grubs, berries, and is particularly fond of cherries. So persistent are they in raiding the fruit trees during cherry time, that some farmers forget the birds' many virtues and destroy them. They are found in large flocks in the south where the pot hunters bag them.

A friend gives the following account of the robin's industry and the sparrow's adaptation of means to ends; "I observed a robin with about twenty sparrows following. He soon dragged forth a worm when a sparrow snatched it from his beak and flew off to its nest. With an air of indignation, the robin put the remaining sparrows to flight, when he continued his hunt. Instantly, the sparrows returned and, when a second worm rewarded the robin's industry, another sparrow seized it and made off. The robin seemed as much surprised and hurt as before. This was continued, until I saw perhaps thirty or forty worms thus taken. I know not how many were taken before I arrived or after I left. The sparrows evidently had nestlings and were taking the worms for them."

Robins frequently create needless commotion among the birds yet we cannot help but admire them. The way they run rapidly over our lawns, digging earth worms almost beneath the spraying hose, demonstrates their fondness for the habitations of man, although, like the wood thrush, a few still retire to the uncultivated land to nest.

Unless the nest is in a conspicuous place where people frequently pass, the female becomes greatly disturbed at the approach of an intruder and chirps angrily, calling to her mate to join in the attack. Many a sitting robin would remain unnoticed if it were not that her suspicious nature invites attack. Unfortunately, the family cat too often causes tragedies in the robin's home. It is well to kill the cat or protect the nest from her ravages.

A careful observer relates that a pair of robins nested for five years in an old apple tree in their yard. On the sixth year when they returned to the old nesting site,

they appeared disconsolate for some days. They then went over to an old pear tree and began their nesting and were again happy. When the leaves came forth the apple tree was found to have been winter killed. The birds had wished the protection of a tree with foliage.

We are apt to find the robin's nest on a fence post, in one of the orchard trees, in a shade tree, or in some nook or corner of the house or barn. The nests are composed of roots and grass, strongly cemented with a quantity of mud. The lining is usually entirely of soft, dry grass. The robin's egg is easily described by the term, "robin's egg blue" which shade is given to the three or four elliptical eggs laid in April or May. A second brood is hatched from forty-five to sixty days later, the male in the meantime taking charge of the first brood after they leave the nest.

763. VARIED THRUSH. *Ixoreus naevius naevius*. 10 in.

The Varied Thrush is a handsome bird inhabiting the Pacific coast region of the United States, breeding from California northward into the wilds of Alaska, but principally in British possessions. In spite of its supposed western range three or four specimens have been recorded along the Atlantic Coast in New Jersey, New York, and Massachusetts.

The varied thrush feeds chiefly upon the ground, obtaining insects and bugs by scratching away the leaves and exposing the earth in damp situations. They also are fond of wild berries and fruit.

The mating song in early spring and later in Canada is beautiful, reminding one of the robin. It is sometimes, though incorrectly, called western robin.

The nests are placed in ordinary localities, usually a few feet above the ground in a shrub. Dry grass, moss, and lichens, intermingled with dry stems and rootlets are used in constructing the nest. The eggs are pale grayish blue sparingly marked with brown specks.

765. WHEATEAR. *Saxicola ænanthe ænanthe*. 6.1 in.

The range of the Wheatear, or Stone-chat, is nearly cosmopolitan, occurring in Europe, North Africa, Asia, and Greenland. The accidental visitors to this continent have been observed in Labrador, Nova Scotia, and other points along the Atlantic Coast. In the British Isles he is one of the commonest birds.

Mr. Saunders writes, "From early spring onward, the wheatear is to be seen jerking its white tail as it flits along uttering its sharp 'chack-chack' on open marshes, moors, and uncultivated places." Some ascend the mountains almost to the highest altitudes. The song of the male is rather pretty and the bird also displays considerable powers in imitating other species.

The nests are usually well hidden among the crevices of rocks and boulders, sometimes in an old well, a quarry, a gravel pit, in excavations made by sand martins, or even in deserted rabbit burrows. The nest is merely an accumulation of grass, moss, hair, and other soft material in which four to six pale blue eggs are laid in May and June.

766. BLUEBIRD. *Sialia sialis sialis*. 7 in.

The common and familiar Bluebird is an inhabitant of all the states east of the Rocky Mountains from the Gulf northward into Canada. It winters as far north as southern Illinois in the Mississippi Valley and Pennsylvania in the east, thence south to the Gulf. In the spring it is one of the first migrants to arrive in the northern states, and is always welcomed as an indication of the final breaking up of winter.

The upper parts of the plumage in both sexes are blue, darker in the male, but the shades vary greatly in both sexes. The breast of the male is a rich chestnut brown; that of his mate is several shades paler. In America we have no other member of the family, save the western form of the bluebird, where brown is not the predominant color among the thrushes.

The notes of the bluebird are as sweet as they are simple. There is something in the character of the notes that reminds one of the wood pewee's song, if such the latter may be called. Their sweet carols convey the idea that the birds take life seriously. As the bluebirds are passing overhead late in October, their sad notes bring a realization that the days of blossoms and verdure are past and bleak, wintry weather is in store.

At no season of the year does this species appear over demonstrative. The actions at all times are modest and reserved, seeming to show the result of good breeding. He has neither the cunning of the jay, the aggressiveness of the kingbird, nor the cherry stealing habit of his near relative, the robin.

The bluebird's arrival is simultaneous with that of the meadow-lark and robin, a trio that inspires the feeling that spring has really returned. The most sentiment is associated with the return of the bluebird because the mellow warble is uttered about our dooryard, perhaps on a nearby wire.

"The bluebird has not been accused of stealing fruit or of preying upon crops. An examination of 300 stomachs showed that 76 per cent of the food consists of insects and their allies, while the other 24 per cent is made up of various vegetable substances, found mostly in stomachs taken in winter. Beetles constitute 28 per cent of the whole food, grasshoppers 22, caterpillars 11, and various insects, including quite a number of spiders, comprise the remainder of the animal diet. All these are more or less harmful except a few predaceous beetles which amount to 8 per cent. In view of the large consumption of grasshoppers and caterpillars, we can condone this small offense. The destruction of grasshoppers is very noticeable in August and September, when these insects form more than 60 per cent of the diet.

"It is evident that in the selection of its food the bluebird is governed more by abundance than by choice. Predaceous beetles are eaten in spring, as they are among the first insects to appear; but in early summer cater-

pillars form an important part of the diet, and are replaced a little later by grasshoppers. Beetles are eaten at all times except when grasshoppers are more easily obtained. So far as its vegetable food is concerned, the bluebird is positively harmless."

They take readily to artificial nesting sites and appreciate bird boxes and cotes that are erected for that purpose. Every dooryard should be adorned by such a bird house. They return annually to build their nests in the hole in the old apple tree. Dry grass is the principal composition used in constructing the abode. Four or five light blue or sometimes pure white eggs are laid in April or early May. Frequently a second brood is raised in July.

768. MOUNTAIN BLUEBIRD. *Sialia currucoides*.
7 in.

This handsome bird of the Thrush family is more delicately colored than our eastern bluebird. It may be found in the territory from Colorado to the Pacific ranging northward through the mountains to the Hudson Bay country. In some localities it is known as the Rocky Mountain, or Arctic, Bluebird. The habits are similar to those of the bluebird.

The birds feed upon insects, worms, wild fruit, and seeds. They are able to adapt themselves to climatic conditions and weather some of the severest storms.

In certain portions of our western states the birds show a preference for the habitation of man and build their nests in nooks and crevices about barns and sheds. Frequently the deserted excavations constructed by various woodpeckers are used as nesting sites. Dry grass is the chief and often only article used in constructing the nest. Four or five pale blue eggs are laid. Like our eastern bluebird, the young when able to fly are escorted by the male while the female prepares the nest for another setting.

25. NESTS AND EGGS.

The Nests and Eggs here shown are photographed from specimens taken from the author's private collection. The treatment of the individual nest is given in connection with the discussion of the bird so is not repeated here.

The several articles may be found on the Manual pages, while the bird is shown on charts, as indicated below:

	CHART NO.	MANUAL PAGE.
Nest of the Shoveller.....	III	112
Nest of the Redhead.....	IV	114
Nest of the Least Bittern.....	V	126
Nest of the King Rail.....	VI	131
Nest of the Florida Gallinule.....	VI	135
Nest of the Wilson Phalarope.....	VI	137
Nest of the American Goldfinch.....	XVII	248
Nest of the Cedar Waxwing.....	XIX	269

26. FAMOUS FOREIGN BIRDS.

These birds are famous for various reasons. Most of them are noted for striking characteristics which will be brought out in the special article descriptive of each.

The lyre bird and motmot are noted for their remarkable tails. The parrot is famous for its bright colors, its peculiarities of claws and beak, and for its ability to speak. The robin redbreast, the skylark, and nightingale have become household words and universal favorites in Europe.

Only a few foreign birds have been selected, as we are in the main more interested in our native birds.

DOUBLE YELLOW-HEADED PARROT. *Conurus mexicanus*. 15 in.

This bird is a native of Mexico, being especially common in the wooded bottoms of the La Cruz river.

It feeds on mangoes and nuts. The eggs are deposited in hollow trees but no nests are made. This beautiful bird is a favorite pet because it is easily domesticated and readily learns to talk. As in other parrots, the upper mandible is movable. Two toes are directed forward and two backward. Both feet and beak of these arboreal birds are used in eating and climbing about the branches of trees.

COCK OF THE ROCK. *Rupicloa crocea*. 12 in.

The Cock of the Rock is a native of South America. The males perform a most remarkable dance at time of breeding season. The Emperor of Brazil had a state mantle made from the highly prized skins. These birds build a nest on a rock near the water.

YELLOW-THROATED TOUCAN. *Ramphastos erythrorynchus Rhamphostida*. 18 in.

The Yellow-throated Toucan, a large billed bird found in tropical America, bears some resemblance to the hornbill of Asia and Africa. The most striking feature of this handsome bird is the monstrous bill, and the bird's chief mission seems to be to care for it, as it frees its beak from every stain and carefully tucks it away among its feathers or rests it on its back while sleeping. The bill seems entirely out of proportion to the size of the bird, but it is of a light honeycombed structure and is not so heavy as it appears. It has been suggested that the bill masticates the food since the bird has no gizzard. The awkward hopping gait is in striking contrast to the easy graceful flight. It feeds on fruits principally, but eggs, fish, and even small birds may enter into the diet. While feeding a sentinel is stationed to give the cry "Toucano," from which the name is derived. Toucans live in flocks in forests, nesting in hollow trees. These birds are killed not only because of their beautiful plumage but also as food.

LYRE BIRD. *Menura superba*. 12.5 in.

The Lyre Bird is a native of Australia, New South Wales, and neighboring islands. In New South Wales it is called the lyre pheasant. It is a bird of terrestrial habits, being a poor flier and percher but a swift runner. Wary and timid it frequents an extensively wooded country. The largest song bird, being about the size of a pheasant, it has the rare power of imitating the songs of other birds and even the cries of animals. A small hillock is made upon which the male bird walks while spreading his remarkable tail, which is the striking feature of this interesting bird. The lyre shape of the tail, from which the bird has taken its name, is assumed only when the bird is strutting at nesting time. As a single egg only is laid, the bird is threatened with extinction.

SWALLOW-TAILED INDIAN ROLLER. *Coracias garrulus*. 12 in.

The Swallow-tailed Indian Roller, a native of northeastern Africa and Senegambia, is called "roller" because of its habits of rolling or turning over in its flight like a tumbler pigeon. This arboreal bird perches high on bare branches. These gregarious birds nest in company in ruins, in burrows, in holes in rock, and in steep cliffs.

SKYLARK. *Alauda arvensis*. 7 in.

The Skylark, a native of Europe and Asia, is famed for its wonderful flight and song. It is closely related to our horned larks. While singing it rises into the air until lost to sight, uttering a rich, melodious carol. In May the birds build their nests on the ground. Many attempts have been made to introduce these birds into America, meeting with greatest success in western Oregon and Washington, while the attempts have only partially succeeded on Long Island and in southeastern Ohio. As this bird is not migratory there seems to be no reason

why it may not flourish in the United States. The song has inspired the poets to their loftiest flights. Read Shelley's "To a Skylark."

NIGHTINGALE. *Luscinia philomela.* 5.6 in.

The Nightingale is found throughout southern Europe and southwestern Asia, wintering in Africa. This noted bird, about the size of a small sparrow, is the most famous bird for its song. It is migratory and arrives in England about the middle of April. As a cage bird, it makes a happy, contented one, though only those birds raised from the eggs will endure captivity. The male only of this bird of song and story can sing. That he sings at night when all else is quiet is said to be one reason for his fame as a musician. All attempts to introduce these birds into the United States have failed as might have been anticipated since the bird is migratory.

MEXICAN MOT MOT. *Momotus momota.* 12 in.

These interesting birds are natives of southern Mexico, Central America and northern South America. Building no nest they deposit the eggs in depressions of sand, generally on the side of a hill. The interesting feature about these birds is that they trim their own tail feathers. They have two long feathers naturally barbed to the point, but the middle portion of the barbs is sheared off by the beak, it is said in order to preserve the balance of the birds in flight. This shy bird lives in dense forests and feeds on insects and berries. The note is a peculiar call, "Houton, houton," from which call is derived one of the names.

ROBIN REDBREAST. *Erythacus rubecula.* 6 in.

This typically foreign bird must not be confounded with the American robin. This bird is the robin red-breast of childhood tales and has been the inspiration of many writers of prose as well as of poetry. In no part

of its range, which covers the whole of Europe, the northern portion of Africa and eastern Asia, is the redbreast so revered as in England. Its sprightly air, inquiring and sagacious demeanor, its intelligence, and its trust in man makes the redbreast a general favorite.

The redbreast not only remains at a distance from other small birds, but also shuns the society of its fellows. No matter how numerous the individuals may be in some hedge, each is for itself and the truthfulness of the old saying, "One bush does not harbor two redbreasts," is apparent. Though bold and pugnacious, it does not appear that the males often give battle to each other for possession of a mate. Their solitary habits would preclude such battles. But once they have selected a breeding locality and built their home, they exhibit much resolution and in a most determined manner resist the intrusion of all other birds.

Though far from neighborly, the male is always very attentive to his mate. He seldom leaves her long and never goes very far away. With his sweet voice he is constantly encouraging her with song during the whole period of incubation. When the baby birds appear he gallantly helps his mate to feed the little ones, no light task, for the young number five to seven.

Usually the site selected for the nest is concealed by a dense foliage. If such a site is not obtainable, the birds will often conceal the nest by an ingenious arrangement of dry leaves. This interesting bird-home may be placed almost anywhere, and sometimes the oddest places seem best to satisfy the whims of this little bird.

Not only is the redbreast an interesting bird, but it is an exceedingly useful one, as it destroys insects on the lawns and among the shrubs and flowers. When hunting upon the ground it approaches its prey with rapid hops and seldom misses as it pounces upon caterpillars, beetles, moths, earth worms and flies. When insect food is scarce and even at other times the redbreast enjoys the crumbs of the dooryard. (Adapted from "Birds and Nature.")

27. INTRODUCED PHEASANTS AND GROUSE.

The Pheasant family includes nearly one hundred species, all of which, with the exception of the Yucatan turkey and the wild turkeys of the United States, are natives of the Old World, where more species are found in southern Asia than elsewhere. To this family belong the peacock and the interesting jungle fowls from which our domestic chickens have been developed. Many of the pheasants are remarkably beautiful birds. Some of these foreign species have been successfully introduced into the Pacific States and in British Columbia.

GOLDEN PHEASANT. *Phasianus pictus*. 28 in.

This beautiful bird is a native of China, as are most of the pheasants. It is being bred with partial success in various places in the United States; for years it has graced city parks. The introduction of these birds into Washington and Oregon has been successful. Great flocks of them are seen in the fields and at the edges of the woods. They have been protected by law until they are so numerous that a limited open season for hunting is now allowed.

In various other states these fine birds have been introduced with varying success. In Illinois, Missouri and various places in New York and the New England States enterprising citizens have placed colonies of them. If they are kept within an enclosure until they become used to the locality, they seem to remain and increase in number, if not, they often scatter and are killed by hunters who mistake them for tropical birds.

The flesh, as in the case of other pheasants, is fine eating, but the beauty is such that one is reluctant to kill them for food. The bright artificial fish baits are usually made from the tips of the bright colored feathers.

RING-NECKED PHEASANT. *Phasianus torquatus*. 38 in.

The Ring-Necked Pheasant, a native of China, has been introduced and acclimated in the states of Cali-

ifornia, Oregon and Washington, and also in British Columbia. In many localities they have become so abundant that an open season is allowed for hunting them. So beautiful are they that taxidermists are kept busy in the open season mounting these birds as an article of commerce. Some of the Central and Western States have introduced these pheasants with more or less success. Dr. Dawson in his "Birds of Ohio" says: "The successful introduction into our state of this splendid game bird really marks a new era in the history of sports, and its event should be hailed with delight by all true sportsmen. Quick on the wing, rapid, prolific, hardy, this handsome pheasant is admirably adapted to take the place of those larger native game birds, the wild turkey, the prairie chicken and the ruffed grouse which are no longer available to us." Like our native grouse, whose places they take, they more than pay for the grain they consume, by their destruction of insects. It is said the bird introduced with the greatest success is a cross between the English ring-necked and Mongolian pheasants.

JAPAN PHEASANT. *Phasianus versicolor.* 36 in.

The Japan Pheasant, a native of Asia Minor and neighboring countries, is bred and domesticated with varying success elsewhere although it requires much shelter and plenty of food and is pugnacious in captivity. It has been introduced into the dry portions of western Kansas with some success. Its chief interest is its rare beauty, although its flesh is highly relished. It feeds on almost anything; ants, maggots, acorns, seeds, berries, etc.; it is terrestrial in habit, a swift runner, and is shy and crafty.

SILVER PHEASANT. *Phasianus nycthemerus.* 30 in.

The beautiful Silver Pheasant, a native of Asia Minor, has been bred with only partial success in Europe and in several states of the Union. It requires much care as it seems necessary to protect the older ones from pred-

atory animals and to feed the young in order to insure an increase.

BLACK GROUSE. *Tetrao tetrix.* 22 in.

The Black Grouse is a native of both southern Europe and Asia. The male is called the "black cock," the female the "gray hen" and "heath hen." Black grouse are polygamous, each male leading as many females as he may be able to attract. With the advent of the breeding season, the strutting males resort to some open spot where they utter loud and resonant notes together with strident sounds. The males fight among themselves in order to increase the size of the harem. The varied diet consists of buds, flowers, tender herbage, insects, and in the fall grain in the fields. While semi-domesticated in the great preserves of Europe, it is a wild, wary bird but a special favorite of the gamekeeper and poacher. It has been introduced with considerable success in some localities in the Alleghany Mountains.

28. FOREIGN BIRDS—CONTINUED.

AUSTRALIAN GRASS PARAKEET. *Melopsittacus undulatus.* 6.5 in.

The interesting Australian Grass Parakeet is a native of Australia as indicated by its name. While most of the parakeets and parrots are decidedly arboreal this bird prefers grass lands. It builds no nest but in captivity must be supplied with a log of wood with a rough hole in the middle for nesting purposes. It picks up food with its beak and does not, as true parrots, use the feet for the purpose.

ROSE COCKATOO. *Cacatua leadbeateri.* 12 in.

Cockatoos have tufts on the head, strong beaks, bright plumage, and strong wings. The Rose Cockatoo, an arboreal native of South Australia, is gregarious and

noisy, but not so imitative as the true parrot, hence is not a favorite as a pet.

RESPLENDENT TROGON. *Calurus resplendens*.
7.5 in., with tail 36 in.

The Resplendent Trogon is a most gorgeous bird of mountainous forests in Central America and northern South America. It is especially noted for its remarkable tail. In flight it usually moves slowly and carefully as much as possible toward the wind to prevent disarranging its plumage. So loosely are the feathers attached that in shooting it many of the feathers fall out, so that it is a difficult matter to mount this bird in a way to show its full plumage. It feeds on berries, fruits, and a few insects. As a song bird it is not a success, the principal note being a low "whe-oo, whe-oo," while other notes are harsh.

SOUTH AMERICAN RHEA OR OSTRICH. *Rhea americana*.

The Ostrich family include the African ostrich, casowary and emu, as well as the Rhea. The African ostrich is the most interesting, as it is the largest living bird, sometimes attaining a height of eight feet. Its plumage is used for decorative purposes more than that of any other bird. The wings of this bird, like those of the rhea, are of no use for flight but help balance the bird in running. The rhea, like the African ostrich, is a swift runner but will take to water and swim when pressed, it also is a stupid bird. While the African ostrich leaves its egg in the sand to be hatched, the male of the rhea incubates the egg. As might be inferred, a bird of this size unless domesticated is exterminated in time as the country becomes settled, so the rhea is threatened with extermination.

RED BIRD OF PARADISE. *Paradisea rubra*. 12 in.

This gorgeous bird is found in New Guinea and the Islands of Maigion. The plumes are highly prized for

hats and other decorations, because of their beauty. The large coarse feet were formerly removed before the beautiful birds were sold to the Europeans, hence the name "apoda," or footless. This gave rise to the superstition that they had no feet and that they had really retained their form from the Garden of Eden. While beautiful as mounted birds, they must be seen flying about the trees to enable one to appreciate their dazzling beauty. The note is loud and harsh, they are gregarious, and feed on fruits and insects.

PEACOCK. *Pavo cristatus*. 33 in.

The Peacock, belonging to the pheasant family and a native of India, is a gorgeous bird. It prefers wooded mountains and jungles, roosting in trees and making the nest on the ground. Often considered the handsomest and proudest of all birds, the Greeks and Romans called it the "Bird of Juno." When the male is in full plumage and spreads his magnificent, fan-shaped tail it is a most dazzling spectacle. Both sexes are alike at first but the male, in three years, gradually acquires the splendid plumage for which it is noted. While it has been domesticated in many countries for centuries, it still continues rather wary. In spite of its beauty and delicious flesh, it is not a favorite domestic fowl for the reason that it is destructive to gardens, has a loud, harsh cry, and has a proud unpleasant disposition.

HOMING, OR CARRIER, PIGEON. 16 in.

There are many varieties of pigeons. The various domestic pigeons originated from the blue rock pigeon, a bird of extensive geographical range. This bird adapts itself readily to the restrictions of civilized life. For centuries pigeon breeding has been a favorite pursuit of bird fanciers. Scientists have been studying the problem of evolution by means of the various breeds of pigeons that have been developed. Among these very interesting varieties is the Homing, or Carrier pigeon. This bird has had the homing instinct most remarkably

developed, returning to its home with messages usually by the most direct route for even hundreds of miles. The best carriers must be carefully bred, mated, housed, and fed and must be sent out alone; if mates are sent they loiter on the way. The males share in hatching the eggs.

CROWNED PIGEON. *Columbida goura*. 21 in.

Crowned Pigeons pair for life and it is said they grieve over the loss of a mate. Little is known regarding these giants among pigeons, but it is hoped to domesticate them in America.

CANARIES. *Serinus canarius*. 5 in.

The Canaries, natives of Canary Islands and neighboring tropical islands, have been introduced into all civilized countries. They are the favorite cage bird. All of the many varieties are excellent singers though imported ones are apt to lose the power of song. They are happy and contented in captivity and require comparatively little care though they should be carefully watched for parasites, which may destroy the handsome plumage, check the singing, or even kill the birds. Skilled breeders develop the voices of the birds, training them by the use of special whistles and by the songs of birds already trained. These birds sometimes live to be fifteen years old. The plumage in the wild state is olive green, touched with brown, the yellow plumage of the cage bird being the result of breeding.

29. MINERALS AND GEMS.

Even an elementary study of the forms here pictured and an investigation into their causes and histories would necessitate the compilation of a very elaborate textbook. Such would be properly called a mineralogy, and it would be used only in work of a collegiate character.

Children, however, would be glad to hear a brief statement of the causes and manner of formation of some of the materials illustrated.

It is well known that the intensely heated interior of the earth is subjected to enormous pressure caused by the weight of the overlying rocks. With cooling comes the slow shrinking and contraction of the crust or outer portions. Under such conditions of heat and pressure many substances are molten or fluid but become hard if they reach the surface or otherwise become cool. An example of these is lava which is poured in a more or less fluid condition from the craters of active volcanoes. While in the fluid condition there is a strong tendency for the ingredients of rock to gather together into masses of varying size and these, upon cooling, form crystals. If the cooling be slow, the crystals have ample time for formation and will therefore be large. By "slow" is meant a very long period of time perhaps a thousand years. Examples of such formations are the diamond and the garnet, the pictures of both of which show both the central crystal and the surrounding material called *matrix*. The colors of these gems are due to various ingredients such as iron, manganese, cobalt, etc. The white diamond is practically pure carbon.

It often happens, however, that when rocks solidify cavities or pockets are formed, perhaps from gas bubbles, and into these there later penetrates water which is on its way upward to the surface from great depths below. When under the influence of the intense heat and the enormous pressure of the interior, water will directly dissolve certain substances which ordinarily it would not, or it may dissolve certain minor substances, thus forming strong acids or alkalies, which further dissolve the most refractory materials. Through cracks, crevices, or sometimes open vents, this water with its load of dissolved materials slowly percolates, finally rising toward the surface. As the pressure and heat diminish, the materials which cannot be carried in solution are deposited along the sides of the passageway or around the walls, and in cavities into

which the water has penetrated. The crevices become filled and other channels may be opened at other places. In any event, the result is the formation of a mineral vein or a nodule, the characteristic structure of both of which is well illustrated in plates one, three, and four, on chart 29. The agate was probably made during a long period of time and the successive layers, being composed of unlike substances, formed bands of dissimilar colors. Such, in a very general way, is the story of the formation of a vein of gold-bearing quartz, of lead, of silver, and other materials, and that of the innumerable agates and carnelians.

The central picture on chart 29, that of the geyser in action, illustrates what has been said of the work of underground water. In this case, water accumulates some distance below the surface in a cavity which lies in or near a bed of rock which has only recently come to the surface and is still very hot. This water becomes heated until steam is formed. This steam expands and with explosive violence forces upward and out the water in the throat of the geyser. The whole operation is repeated periodically, as often as the proper conditions of temperature and pressure are met. That Yellowstone Park is a region of very recent volcanic activity is shown by its numerous active geysers and hot mud springs. In any elementary physical geography will be found an interesting account of volcanic action and the work of underground water, not only in such cases as those mentioned here but also in the formation of caverns. Thus chart 29 suggests a very wide field of reading and research into the history of the earth and into economic or industrial geology.

QUARTZ.

The varieties of quartz are many. They vary in colorings and markings. They include chalcedony, carnelian, sard, chrysoprase, prase, plasma, bloodstone, agate, onyx, sardonyx, jasper, basanite, flint, and hornstone.

Quartz nodules are found as rolled or worn pebbles on shores of lakes and in beds of streams. Its finer particles, sand, mixed with organic matter, form soil. Gems of this group take a high polish and are used for ornamental purposes.

AGATES.

Agates are a form of quartz used for making marbles, table tops, inlaid work, bearings for delicate instruments, and jewelry.

GEODES.

Geodes are the quartz centers or cores of former pockets; the surrounding softer rock materials have been worn away until only the quartz is left.

DIAMOND AND CORUNDUM.

Diamond is the hardest of minerals and corundum is the next below it in hardness. Diamonds vary in color and purity, carbonado being a very impure form. Most of the diamonds come from South Africa, Brazil and India. Diamonds have been found in meteorites.

H. B. S.

30. FLOWERS.

Flowers are the essential parts of higher plants as they are necessary to fruit and seed formation. Some flowers are beautiful and fragrant while others are neither; some are large and showy, but emit a disagreeable odor. The part of the flower which attracts the eye is usually the corolla, formed of the separate or united petals which vary in size, form and color. Somewhere near the base of the corolla are found the nectaries or glands which secrete the nectar so highly appreciated by insects and from which nectar the bee makes its honey.

Flowers of different species of plants open or develop at different periods of the season of active growth. Some open early in spring, while others do not develop until late in the fall.

Double flowers (culture products of gardens, etc.) are generally considered handsomer than the wild unchanged or normal flowers.

EASTER LILY. *Lilium harrisii*.

The Easter Lily is a large white, trumpet-shaped, simple flower with yellow stamens. It is a great favorite, figuring for many centuries in religious ceremonies as well as in history; it is especially popular at Easter time. Originally introduced from Bermuda, it is now extensively cultivated in nearly all countries.

CARNATIONS. *Dianthus caryophyllus*.

These beautiful, fragrant, aromatic flowers are extensively cultivated in gardens. Natives of central and southern Europe, they have become more or less naturalized in many countries. They are related to the pinks (Sweet William, Chinese pink, Indian pink). Pink and white varieties predominate.

LADY'S SLIPPER. *Cypripedium reginae*.

The corolla of the Lady's Slipper is of showy irregular petals. It is a native of eastern North America from Canada to the Gulf of Mexico, found in swamps and moist woodlands. Reckless gathering and swamp drainage are exterminating these plants.

LIBERTY ROSES. *Rosa rosacea*.

This is one of the handsomest of the many varieties of cultivated roses, having numerous deep red petals. The original wild ancestor of the various cultivated varieties is perhaps unknown. Three or four species are usually cited as representing the original stock. Roses have been cultivated for many centuries and the gardener continues to produce new varieties.

LILY OF THE VALLEY. *Convallaria majalis.*

These small plants with small, handsome, white, symmetrical, fragrant flowers are much cultivated in lawns and gardens. It is a native of the mountainous regions of Virginia, the lily of the valley of Solomon's time being a different flower. The lily of the valley is highly valued in medicine as a heart tonic, and is poisonous as are most medicines.

HYACINTH. *Hyacinthus orientalis.* *Compositæ.*

The Hyacinth is a handsome plant with large clusters of beautiful flowers, varying in color with the numerous varieties in cultivation. The wild ancestor is said to have been an insignificant plant.

GOLDEN ROD. *Solidago virga aurea.*

The separate flowers of the Golden Rod are very small with comparatively few on each receptacle, but of a bright golden color; the flower heads are numerous and make the plants attractive. The golden rods are essentially natives of America, and form one of the attractive autumn features of our landscape, being common along roadsides and in meadows, but is not cultivated. It has been suggested that the golden rod be made our national flower.

SENSITIVE PLANT. *Mimosa pudica.* *Leguminosæ.*
(Awake and asleep.)

These modest, small plants with rather showy flower heads close the leaves and droop at the slightest touch. This serves as a protection against frost during occasional cold nights in spring, by reducing surface exposure and heat radiation. This plant is often cultivated largely because of its peculiar habits, though the plant itself is delicately handsome. The work of the photographer was perfectly done in this instance; one group showing plants awake and the other group showing them asleep.

CALLA LILY. *Richardia Æthiopica Aracea.*

These plants are closely related to the Indian turnip, or Jack-in-the-Pulpit. The flowers are characterized by a flattened spathe within which is a cylindrical spadix covered with naked flowers, appearing as a mere mixture of stamens and pistils. One bog calla is eaten by the Laplanders. The calla lily of the greenhouse is a native of South Africa.

31. MEDICINAL PLANTS.

Medicinal plants are used in the treatment of diseases. The active principle is usually extracted in some manner, then given internally or applied externally. In some instances, the dried plant or plant part is reduced to a powder and taken internally. Some medicinal plants are found in the wild state only, but most of them are also cultivated.

Medicinal plants have been in use since time immemorial and at some time nearly every known plant has been tested and used medicinally whether it possesses any healing powers or not. The tendency at the present time is to reduce the number of drugs and hence, drug-yielding plants. Not so many years ago, the physician prescribed hundreds of different species of plants, while the modern physician rarely uses more than twenty-five or thirty. Many plants still retained in the official list might as well be excluded as they have practically no medicinal virtue.

Our most valuable medicinal plants are also poisonous, a fact well worth remembering. There are, however, many poisonous plants which are not used medicinally.

LICORICE. *Glycyrrhiza glabra. Leguminosæ.*

In Licorice the juice of the underground part (roots and rhizomatous stems) is used. When dried, this ex-

tract is black, brittle, and sweet. It is used in the manufacture of licorice sticks, drops, lozenges, etc., and is merely a demulcent in coughs and colds and has no marked curative properties. Most of the licorice (roots and stems) comes from Spain and Russia.

POPPY. *Papaver somniferum.* *Papaveraceæ.*

This handsome plant with its large showy flowers is largely cultivated in gardens and in fields. All parts of the plant emit a heavy nauseating odor. The partially dried juice obtained from the incised fruit heads constitutes gum opium of the drug market, from which is prepared morphine, laudanum, paregoric and other alkaloidal salts and preparations. Opium and its various derivatives are pain relievers and sleep producers, but have no intrinsic curative powers, and great danger attends the use of these drugs. The Orient produces most of the opium. China has been terribly cursed by opium, but the aroused nation is now making efforts to outlaw the evil.

HOPS. *Humulus lupulus.* *Urticaceæ.*

Hops are rather large creeping and twining plants extensively cultivated in sub-tropical countries (Spain, southern France, southern and western United States, etc.), on account of the fruit (strobiles) which is used in medicine, and in the manufacture of beer and yeast. Like opium, the hop has no curative properties, though it is an excellent sleep producer and an alleviator of moderate pain.

DANDELION. *Taraxacum faraxacum.* *Compositæ.*

The Dandelion is a native of Europe, perfectly naturalized in America, and is a very familiar plant in yards, lawns, along roadsides, etc. It has no marked medicinal properties though formerly believed to be a remarkable liver regulator. Dried roasted ground roots are often used as an adulterant of ground coffee.

TOBACCO. *Nicotiana tabacum.* *Solanaceæ.*

Tobacco is a rather tall, large leaved plant, extensively cultivated in warmer countries, and successfully grown as far north as southern Wisconsin, which is one of the great tobacco raising regions. The culture requires a rich soil and when ripening a damp climate. The leaves after being especially prepared are used as snuff, chewed, and smoked. The active principle, nicotine, is one of the most powerful vegetable poisons. It is very little used in medicine, its action being too uncertain and dangerous. Its use by the young tends to stunt growth and to injure physically, mentally and morally.

CUBEBS. *Piper cubeba.* *Piperaceæ.*

Cubebs, natives of Java, are extensively cultivated in tropical countries and islands. The pepper-like fruits with their peculiar odors were formerly used as a spice, later as a medicine. Its use both as a spice and a medicine is waning.

MAYAPPLE. *Podophyllum peltatum.* *Berberideæ.*

The Mayapple is a small two-leaved, single flowered, single fruited plant of American woods. The flower is large and waxy white; the fruit resembles a tomato; the underground stem (rhizome) is highly valued medicinally. The common name, mandrake, is wrongly applied as the mandrake is a European plant.

COCA. *Erythroxylon coca.* *Lineæ.*

Coca is a shrubby plant of South America the leaves of which have been used for many centuries by the natives of Brazil as a stimulant, chewing them mixed with some plant ash. Medicinally, they yield cocaine, a very valuable local anesthetic much used in dentistry and minor surgical operations. Unfortunately its use is attended with danger as the cocaine habit leads to a terrible slavery.

THYME. *Thymus labiata*.

The genus *Thymus* comprises a number of fragrant, aromatic under shrubs with very small leaves and whorls of small lilac flowers in the axils of the leaves, or at the end of the branches. The common garden thyme is a native of the Mediterranean region. These plants are remarkable for their essential oil to which their fragrance is due. From this oil is produced by distillation a substance known as thymol, analogous to camphor. It is used as a disinfectant and germicide. It is brought into especial prominence because of its relation to the "Hook Worm" of the South as it destroys these pests and gives promise in time of stopping the ravages of this strange disease that so long remained a mystery.

32. SPICES, ETC.

Spices of various kinds have been in use since the history of man. Their purpose has been to give an agreeable flavor to food, rendering it more palatable and to stimulate digestion. Most of the spice-yielding plants are tropical or sub-tropical and are all extensively cultivated. Any part of the plants may be used. In the case of the peppers and allspice, it is the dried fruit which is employed; in the case of cinnamon, the bark is used. Ginger is an underground stem or rhizome; nutmeg is a seed; mace is a fruit covering (arillus); clove is a flower; mother-of-clove, a fruit.

A moderate use of spices does perhaps no harm, but an excessive use of these artificial adjuncts to digestion causes an inflammatory condition of stomach and liver. They also blunt the taste sense. Persons who never use spices are not sufferers, as has been proven repeatedly.

The Dutch are the chief promoters of the spice industry and were the first to cultivate spices on a large scale on the various tropical islands in their possession.

GINGER. *Zingiber officinale.* *Scitamineæ.*

This plant is extensively cultivated in Jamaica, in fact, the island is known as the "land of ginger." The rhizomes, peeled or unpeeled, are dried and used, finely powdered, in pastry baking. in preparing ginger ale and other ginger drinks as well as used as a common spice. Ginger is extensively cultivated also in China, India and northern Africa.

CINNAMON. *Cinnamomum cassia.* *Laurineæ.*

Cinnamon is a pastry and pickle spice. Cinnamon yielding plants are tropical trees, extensively cultivated in southeastern China, India, Sumatra, Java, etc. There are a number of different species, all of which yield cinnamon bark. The so-called Saigan cinnamon is the best. Purchase the bark, as the ground cinnamon is frequently adulterated.

CLOVE. *Eugenia aromatica.* *Myrtaceæ.*

The Clove is a much cultivated native tree of tropical countries especially islands. The flowers are gathered and dried before they are opened. This favorite spice is much used in pickling. Clove oil is a popular remedy in toothache.

NUTMEG. *Myristica fragrans.* *Myristicaceæ.*

Nutmeg, a medium-sized tree, is extensively cultivated in tropical countries, especially islands of both hemispheres. The seeds usually appear on the market dusted with lime which keeps away destructive insect larvæ. This spice is less used than formerly. Connecticut is called "Nutmeg State" because of the standing joke that wooden nutmegs are made there. Mace is the inner covering of the nutmeg, red and somewhat fleshy when fresh. It is prepared for market by drying in the sun. Like the nutmeg it is used as a spice, having a flavor similar to the nutmeg.

TEA. *Camellia Thea. Ternstræmiaceæ.*

Tea is a shrub whose dried leaves furnish the tea of commerce. It grows naturally from twenty to thirty feet in height but in cultivation is trimmed back to five or six feet. The leaves are from two to six inches in length. The flowers are large, white, and fragrant. Tea farms are mostly in the north of China and are usually small as their care requires much attention; the soil must be richly manured and kept clean from weeds. The evergreen leaves are gathered at certain seasons. The best tea is gathered in April when the young leaves appear, and are made into Young Hyson of the finest quality. The ordinary picking begins after summer rains are over at the beginning of May. The picking of the poorest tea is done later in the season. When drying the leaves are so roasted as to produce the varieties of flavor of the various kinds. The different colored teas, as green and black, are other results of the method of treatment. The leaves for green tea are roasted in pans soon after they are gathered, they are rolled and returned to the pan for more roasting in order to fix the color. For black tea the leaves are left exposed to the air and are finally roasted over a charcoal fire. The tea drinking habit is as pernicious as the coffee habit; both are mild stimulants due to a single active principle known as caffeine in coffee and theine in tea.

PEPPER. *Piper nigrum. Piperaceæ.*

Pepper is a plant much cultivated in the East Indies and other tropical countries, being the most largely used of all spices. When cultivated the plant is supported by poles or by small trees planted for the purpose, as it is a climbing and trailing plant, thriving best when somewhat shaded. It bears fruit in three or four years after it is planted, yielding two crops per year for about twelve years. The ripe berries are a bright red but when dried become wrinkled and black. The immature dried berries constitute the black pepper of commerce, while the ma-

tured, perfect, dried, and peeled fruit is white pepper, black pepper being the more pungent.

SUGAR CANE. *Saccharum officinarum.* *Gramineæ.*

Sugar cane is a perennial, jointed, reed-like plant six to twelve feet high, extensively cultivated in the southern states, Cuba, etc. It produces no seed, being propagated from rhizomes and cuttings. The juice yields molasses and cane sugar. It is entirely different from the sugar cane of the Central States which yields "sorghum molasses." Because of the vast amount of beet sugar now made, cane is relatively of less importance than formerly. The sugar of commerce is formed in the stems or canes of the plant from which the juice is crushed by heavy rollers. This juice ferments quickly so is purified and evaporated as soon as possible. Lime and sulphuric acid are added to the juice when it is passed through filters and finally evaporated by heat in vacuum pans. The sugar is allowed to crystallize in the sirup from which it is separated by centrifugal force, leaving the sirup as the molasses of commerce.

COFFEE. *Coffea arabica.* *Rubiaceæ.*

Coffee is the fruit of a small tree of the same name extensively cultivated in tropical countries of both hemispheres. It is a native of Abyssinia and Arabia and some parts of tropical Africa. In the wild state it is a slender tree about twenty feet in height. Under cultivation it is not allowed to become more than six to ten feet high. The fruit is a bright scarlet when ripe, usually containing two cells with one seed each. The tree yields the first crop the third year and three gatherings are made in a year. After being dried, roasted, and ground the seeds are used in preparing the common drink, coffee. The chief kinds are Mocha, Java, Jamaica, and Rio. While coffee allays hunger, exhilarates, refreshes, and perhaps lessens the amount of wear and tear, excessive use produces dyspepsia and wrecks the entire nervous system. Caffeine is the active principle. Ground coffee is frequently

adulterated. Chicory is chiefly used as an adulterant and substitute, some also think it improves the flavor.

VANILLA. *Vanilla planifolia*. *Orchidaceæ*.

Vanilla is an extensively cultivated native of Mexico. Successful cultivation requires great care; pollination is mostly done artificially. Vanilla is a highly valued flavoring extract used with chocolate, cocoa, ices, cold drinks, etc. It was used by the ancient Mexicans long before America was discovered. The fruit is a pod about eight inches long and less than one-half inch thick, filled with a soft black pulp full of small oily seeds. The pods are gathered green, dried in the shade, and cured in oil. Extract from the genuine vanilla is very expensive. The poorer extracts are adulterated with the tonka bean.

33. FRUITS.

Broadly speaking, fruits are as multitudinous in variety as are the species of flowering plants upon which they grow. When the term fruit is used in ordinary language, we generally have in mind those fruits which are edible for man and it is in this restricted sense that the term is here applied.

Edible fruits are found in all countries and grow upon a great variety of flowering plants. They resemble each other in that they contain a high percentage of water, holding in solution acids, sugar, and other substances in variable quantity. Sub-tropical and tropical countries are usually considered the chief fruit countries. It would be more correct to state that all countries yield fruits in abundance, though each zone has fruit plants peculiar to it.

Botanically considered, a fruit consists of the matured or fully developed ovary enclosing the ripened seeds. According to this definition, apples, pears, quince, pomegranate, strawberry and others are not true fruits.

Apples, pears, etc., consist largely of the modified fleshy calyx and the strawberry is a much thickened torus, or receptacle. In some cases only a part of the fruit is edible. There is an outer thin covering commonly known as the peel which is often eaten, but which would better be removed by peeling, as it is indigestible, and may cause trouble. In some cases (banana, orange, lemon) the peel is very thick and wholly inedible. In the case of peach, cherry, and plum, the hard endocarp (shell) is inedible.

PEAR. *Pyrus communis sativa*.

The Pear is a tree belonging to the rose family of the same class as the apple which it closely resembles. A native of Europe, it is still found wild in Britain where it has thorny branches and small, hard fruit. With cultivation the thorns disappear and the fruit becomes larger and finer. The tree lives to a good old age, some in England being over four hundred years old. Near Detroit, Michigan, are found trees said to be nearly two hundred years old. Many of the pear trees are affected by blight. Of the thousand kinds of pears only a few are of real value. The bartlett and the seckel are among the best varieties cultivated in the United States.

PEACH. *Amygdalus persica*. *Rosaceæ*.

The Peach tree, probably a native of Persia, is now generally cultivated where the climate is not too severe. Over four hundred varieties are catalogued. The two chief varieties, clingstone and freestone, each have numerous sub-varieties. The tree is usually short-lived but in England and France sometimes live for one hundred years. Only the mesocarp is edible, the downy peel (exocarp) should be removed. The endocarp (nut shell) is erroneously looked upon as a part of the seed which it encloses. The peach belongs to the same class of drupes, or stone fruits, as the apricot, almond, plum, and cherry. Peaches are gathered for the market when

green and shipped to market by the carloads. The peach canning industry is a large one.

PERSIMMONS. *Diospyros virginiana.* *Ebenaceæ.*

Persimmons are rather small native trees of southern United States. Of the numerous species of persimmon only a few are cultivated. The fruit is not palatable until fully ripened, as green fruit is extremely astringent (puckery).

TOMATOES. *Lycopersicum esculentum.* *Solanceæ.*

The Tomato, an herbaceous plant, is a native of South America, extensively cultivated in gardens and fields. It is related to the potato, belonging to the deadly nightshade family. Formerly raised as an ornament, it was not considered edible until comparatively recent times. There are several important varieties, small, large, red, yellow, etc. The fruit is a berry, botanically considered. It is eaten raw, pickled (green), preserved, etc. According to popular superstition, eating tomatoes causes cancer.

BANANAS. *Musa Sapientium.*

The Banana, a large lilaceous plant of the tropics, has large, long leaves and reed-like stem, on which the heavy bunches of fruit are borne. The plantain and banana are now thought to be two varieties of the same plant. The fruit (remotely berry-like) has no mature seeds; the rich mealy pulp is wholesome and nutritious. The plants also yield vegetable fibre (*musa textilis* of the Philippines). In China a dwarf variety (*musa cavendishii*) is extensively cultivated, of which variety the dried fruit is boiled and eaten. The banana is largely cultivated in the tropics and is one of the main sources of food supply. It has been estimated that land capable of yielding wheat enough to feed one person if planted in bananas may feed twenty-five persons. Thick, tough rind indicates an inferior banana, thin tender rind, marked

by brown spots when ripe, indicates flaky, white, delicious meat.

ORANGES. *Citrus aurantium.* *Rutaceæ.*

The Orange tree, supposed to be a native of South America, is extensively cultivated in many varieties in the warmer countries of both hemispheres. The United States gets most of the supply of the fruit from Florida and California; unfortunately the Florida orange trees are frequently killed by freezing. The orange is a medium sized green tree, with thick smooth leaves and fragrant, white, wax-like flowers highly prized for beauty. The round, yellow, berry-like fruit has a thick rind but a juicy, palatable pulp within containing citric acid. The more common varieties are the Lisbon orange, China orange, blood or Maltese orange, Mandarin orange, and the seedless, or navel orange. The navel orange is a freak which is now grown most extensively in California. Oranges for shipping are picked green and bear transportation well. The orange is, therefore, one of the most universal fruits. Trees in full bearing will yield from three to ten thousand oranges in a year and the trees will often live for one hundred to one hundred and fifty years. In order to show the pupils the presence of volatile oil in rind, bend the fresh peel and direct this oil into the flame of a lighted match. It burns with a bright light.

POMEGRANATE. *Punica Granatum.* *Lythariaceæ.*

The Pomegranate, a small handsome tree, is a native of Persia. In the wild state it is a thorny bush, but under cultivation it becomes a small tree. The fruit is nearly as large as a small orange. Each small seed is surrounded with pulp, enclosed in a thin membrane. It appears like a number of small berries packed together in a thick rind. The pulp is pink and of a peculiar, pleasant flavor. It is cultivated on account of beauty of form and beauty of flowers which have become double. The astringent rind of the fruit and the bark of the root are used medicinally.

STRAWBERRY. *Fragaria chilensis.* *Rosaceæ.*

Strawberries are small, herbaceous plants belonging to the rose family (*Rosaceæ*). They are perennial, propagating by means of runners. The white flowers have the general characteristics of the apple blossom and the rose, that is, five (double) sepals and five petals with numerous stamens and pistils.

The word strawberry is both perplexing and scientifically incorrect. The edible part is not a "berry," but the much enlarged fleshy torus, or receptacle, to which the numerous very small rather hard fruits (seeds) are attached. It is botanically a "false fruit" and not a berry at all. The green, ten-parted, star-shaped, leafy structure found attached to the base of the so-called berry is the permanent calyx, which is removed before the fruit is eaten. The etymology of "straw" has been variously given. According to some authorities the word was originally "strayberry," referring to the spreading habit of the plant, by runners. Others state that the word refers to the straw-like stems. Still others refer the word to the habit of covering the strawberry patch with straw.

About six or seven species are natives of the United States, where they grow wild in prairie lands, as well as in the wooded areas. The best known and most widely distributed species is *Fragaria virginiana* Duch., commonly known as meadow strawberry, wild strawberry and Virginia, or scarlet, strawberry.

The numerous culture varieties are derived from a comparatively few of the fifteen wild stock species. The desirable qualities are sweetness, delicacy of flavor, good size, small seeds, and pulpiness.

Strawberries, for successful cultivation, require rich soil in a protected place. They do not yield a full crop until the second summer after transplanting.

Growers must keep in mind the fact that certain plants produce essentially pistillate flowers and others essentially staminate flowers. Staminate plants are not productive, but are essential in pollination. The yield

of berries varies greatly with soil, climate, cultivation, and variety. Under favorable conditions the yield may be over 200 bushels per acre.

APPLE. *Pomum malus.* *Rosaceæ.*

According to some authorities the wild ancestor of the innumerable varieties of Apple now under cultivation is the crabapple of the Old World. Apple orchards are the most common of all orchards. It would require volumes to describe all the different varieties, which are perpetuated by cuttings (grafting). Varieties are produced by crossing (cross pollination) and artificial selection. The insect pests preying upon the apple have greatly increased largely because there are not so many birds to destroy these pests. New York state is noted for the excellence of the apples. Of late years, certain valleys in the West are found just suited to apple culture. The apple is a false fruit, consisting mostly of fleshy calyx.

CHERRIES. *Prunus cerasus.* *Rosaceæ.*

Cherry trees under cultivation are supposed to be derived from a wild ancestor whose original home was Asia Minor. There are a number of wild species, besides the three hundred kinds under cultivation. The fruit is not a berry, but like the peach and plum a drupe, or stone fruit; the fleshy mesocarp being eaten, however, generally including the leathery rind (exocarp) and often the pit (endocarp and seed). Cherries are extensively canned.

GRAPES. *Vitis vinifera.* *Ampelideæ.*

Grape, a fruit of a vine extensively cultivated, is strictly a berry with from one to four seeds. It grows in clusters and is used for eating, for the manufacture of wine, raisins, vinegar, and cream of tartar. Of the large number of species some grow only in warm regions. In northern United States the best known varieties are the Concord, Isabella, Catawba, Delaware and Clinton. Many varieties of foreign growth have been introduced

with success in California. New York is the leading state for growing the Concord. New varieties are multiplied by propagation. The wild varieties in the United States are inferior.

PINEAPPLE. *Bromelia ananas.* *Bromeliaceæ.*

The Pineapple, so called because of its resemblance to a pine cone, is not a true fruit; it is a double misnomer, being neither an apple nor belonging to the pine family. The edible portion is neither fruit nor seed. The plant has a number of long, smooth-edged, sharp pointed, rigid leaves springing from the root from which a short flower stem is thrown up, bearing a single spike of flowers, so the pineapple is a single fruit. From the top of the fruit grows a tuft of small leaves capable of becoming a new plant. This is the one means of propagation. The pineapple is a native of tropical America, growing wild in Brazil. Requiring a moist warm climate, it is cultivated in Florida and the West Indies, whence comes most of our supply. The pineapple is wholesome and refreshing and is said to have digestive power like pepsin. It is used in diphtheria to dissolve the false membrane in the throat.

34. NUTS, ETC.

This is really a continuation of fruits. In case of nuts, so called, the seed is the edible portion, while that part of the fruit belonging to the ovary (as hull and shell) is wholly inedible. These nut seeds resemble each other in being very rich in oil and comparatively dry. They are, therefore, difficult to digest and should be eaten only in small quantities at a time.

Most of the stone fruits are not especially palatable, hence they are generally rejected, except such as the sweet almond.

ENGLISH WALNUT. *Juglans regia.* *Juglandaceæ.*

The English Walnut, a tall, handsome tree, is a native of India. It is cultivated in England and other countries. Its culture has become an important industry in California. The nut is a great favorite, the kernel being easily extracted and having a rich flavor.

ALMOND. *Amygdalus Communis.* *Rosaceæ.*

The Almond is a tree supposed to be a native of Africa, Persia, and Turkestan. It has been cultivated since remotest antiquity. Sweet varieties and bitter varieties resemble each other very closely; sweet almonds only are eaten; bitter almonds contain a poisonous principle, prussic acid, and are used in flavoring and perfumery. The paper shelled varieties are the best. Almond meal for making a certain hygienic bread has a limited but growing use.

CHESTNUT. *Castanea vesca var. Americana.*

Chestnuts are grown on a forest tree in the United States and Europe. The nuts are grown in a prickly burr, ripening about the time of the first frost. While rich they are a favorite nut and are eaten raw, boiled, or baked. In southern Europe they are ground and baked into bread to be used by the poor. The American chestnut shown on the plate is a smaller and sweeter variety than the European.

HICKORY NUT. *Carya alba.*

Hickory nuts grow on a large beautiful North American forest tree by the same name. The nut, much used as food, is encased in a green outer hull which separates when the nut ripens and allows it to fall to the earth. See Chart 45.

PECAN. *Carya olivæformis.*

The Pecan grows on a variety of hickory. The shell is rather astringent, but the nut is used more than ever as food as improved paper shelled varieties are developed.

BRAZIL NUT. *Bertholletia excelsa.*

The Brazil nut is a popular nutritious nut grown in Brazil. The large outer shell is filled with nuts, making a most peculiar fruit.

PEANUT. *Arachis hypogæa.*

The Peanut, supposed to be a native of Africa, is grown on a trailing plant belonging to the bean family. It is a misnomer, being no nut. After the small yellow flower fades the pod is pushed underground by the stiff stem where it develops into the well-known peanut of commerce. The peanut as an article of diet is growing in use. It is roasted and eaten, also eaten in the form of butter. Oil and soap are also made from the "nuts." It grows in sandy soil. An acre will sometimes produce one hundred bushels.

COCOA FRUIT. *Theobroma cacao.* *Sterculiaceæ.*

Cocoa is a native of Central America and Mexico. The large cucumber-like fruit, called cocoa bean, contains numerous seeds, which after fermenting and drying are ground, flavored with vanilla, and made into nutritious cocoa and chocolate. The fat expressed constitutes cocoa butter, used in medicine.

COCOANUT. *Sterculia alata.*

The Cocoanut is a well-known fruit of the palm tree growing in tropical regions. Cocoanut trees soon spring up on low coral islands. Each tree usually yields from eighty to two hundred nuts which form the main food of some tribes of the tropics. Besides the nutritious meat and milk, cocoanut oil is obtained from which is made a soap that may be used in sea water. Parts of the tree and husk fibre are of commercial value.

BUTTERNUT. *Juglans Cineria.*

The Butternut, or White Walnut, grows on an American tree by same name. The kernel is sweet but oily. It is closely related to the black walnut.

BLACK WALNUT. *Juglans nigra.*

The Black Walnut is grown on a common American tree the wood of which takes a beautiful polish. The fruit is covered with a green husk, turning black when ripe. This husk covers the brown nut which has a thick, hard shell. While eaten the kernel is coarse and oily. Painters use this oil to mix colors; the outer shell is used in dyeing. See Chart 45.

EGG PLANT. *Solanum esculentum.* *Solanaceæ.*

The Egg Plant, an herbaceous plant cultivated in field and garden, has large egg-shaped, tomato-like fruit. The peeled fruit (berry) sliced and fried in lard or butter, is eaten.

QUINCE. *Cydonia esculentum.* *Rosaceæ.*

The Quince is grown on a small tree, bearing the same name, in temperate regions. The fruit is hard and sour, but when stewed with much sugar becomes of a pleasant taste; it is also used to flavor apples and to make a marmalade, or honey. The seeds are highly mucilaginous, as they turn fifty times their weight to a sirup, long used as a medicine.

LEMON. *Citrus limonium.* *Rutaceæ.*

The Lemon is grown on a tropical and sub-tropical tree of same name, being closely related to the orange, lime, citron, and grape fruit. Of the many varieties of the lemon only two general types interest us. First, the ordinary lemon of commerce; second, the Messina, which is a thin-skinned lemon with a delicious juicy pulp. The berry-like fruit is very sour due to citric acid which is useful in curing or preventing scurvy. The ordinary lemon is made into lemonade, a wholesome, cooling drink. The oil, or essence, of lemon is extracted from the peel and the oil dissolved in alcohol. Its chief use is for flavoring purposes.

RED PEPPER. *Capsicum annuum*. and *C. Fastigiatum*.

Cayenne Pepper is a native of Guiana. The plant was introduced into Europe by the early Spanish explorers. It is now cultivated in India and southern Europe. It is a hardy herbaceous plant which attains a height of two or three feet and bears pods annually. Chilies, the dried ripe or unripe fruit of Capsicums, are used to make Chili sauce, etc. Cayenne pepper is manufactured from the ripe fruits, which are dried, ground, mixed with wheat flour, made into cakes, baked hard, then ground and sifted. The pepper is sometimes prepared simply by drying the pods and pounding to a powder. The use of Chilies seems to be on the increase. The biting taste is due to the presence of an alkaloid, Capsicine. Medicinally cayenne pepper is used in a number of nervous troubles; it is also used as a treatment in several forms of dyspepsia, though if taken in large quantities it is an irritant poison.

MAIZE OR INDIAN CORN. *Zea mays*. *Gramineæ*.

Maize, or Indian Corn, also known as corn, is a plant belonging to the grass family (*Gramineæ*). It usually attains a height of about seven feet, the single unbranched stem being jointed, only slightly tapering, with a central pith and an outer hard tissue to give the necessary resistance to heavy winds. Each node (joint) has a single long, sword-like leaf, the lower portion of which encloses the stem (internode) like a sheath.

Corn is a typically monoecious plant, that is, the staminate (male) and pistillate (female) flowers are borne upon different parts of the same plant. The large, feathery panicle at the top of the stalk, generally spoken of as the "tassel," represents the staminate inflorescence. The pistillate inflorescence, formed near the middle of the stalk, consists of a dense spike of flowers of which the styles are greatly elongated, forming what is commonly known as the "corn silk." The female inflorescence is enclosed by numerous broad, leaf-like bracts which is known as the "husk." The fruit, known as the "ear,"

is collective, several hundred individual fruits usually designated as "kernels," being fastened to the spike, commonly known as the "cob."

Corn flowers are not showy, as pollination is effected through the agency of air currents, and in common with other anemophilous (wind-pollinated) plants, large quantities of pollen are formed. On walking through a cornfield in August one will find the ground yellow with pollen dust. The fruit ripens in the autumn, usually shortly before frost.

As with many other domestic and cultivated plants, the wild ancestor of corn is unknown. It is most probably a native of tropical America. Some give Hayti as its native home; others give Peru; as small grains of some unknown variety of corn have been found in the ancient tombs of Peru.

At the present time corn is extensively cultivated in various countries, but nowhere on such an enormous scale as in the Mississippi valley. The Mississippi corn region, with Springfield (Illinois) as its center, produces annually from 10,000 to 15,000 millions of bushels, or about three-fourths of the total crop of the United States. In the Central States corn is cultivated on a large and simple scale, made possible by the rich soil. One man with four horses cultivates from 80 to 100 acres, besides oats and other farm products. Corn requires rich, black, loose soil with good surface drainage, and special climatic conditions. The season must be warm and nights must not be cool.

There are a multitude of varieties of corn and new varieties are continually being produced by the progressive farmer and by the scientific investigators at the various experiment stations. The numerous varieties of what is known as "white dent corn" are now most extensively cultivated in the Central States. Some forty years ago the yellow variety was preferred. The small, hardkerneled "flint" varieties, to which popcorn belongs, are cultivated almost entirely for food purposes. The "sweet corn" varieties are cultivated almost wholly for

eating direct or for canning. The farmer selects and perpetuates a desirable variety or quality of corn by artificial selection. That is, during the husking season he picks out ears having the desirable qualities (large ears with comparatively small cob and deep kernels) and keeps these for "seed corn." The scientist at the experiment stations above referred to aids nature in the production of new and desirable varieties by selection combined with artificial pollination. That is, the pollen of one variety of corn is removed and deposited on the ends of the silk of another variety, performing what is known as artificial crossing. Northern states, for example, can only cultivate an early variety; that is, a variety which matures early. There are also hardy varieties, those which are less readily affected by slight frosts. Varieties comparatively richer in proteids and others richer in starch, etc.

Since corn requires rich soil, manuring and fertilizing of the soil is a very important item. The old time use of guano, manure and other chemical fertilizers is laborious and expensive. Experiments are now in progress to utilize certain bacteria for this purpose, and the results thus far obtained point to ultimate success.

With perhaps the one exception of rice, maize is the most extensively used grain in the world. In fact, all parts of the plant are used. The leaves form an excellent fodder for horses and cattle. The stalks are also used in paper making, and in fertilizing the soil. The husk is used in mattresses.

The most valuable part of the corn is the fruit, generally spoken of as the grain, or kernel. Green corn is highly relished as an article of diet. Although its food value is certainly overestimated, as it is hard to digest. For this purpose sweet corn is preferred. Canning boiled corn removed from the cob is a very important industry. Corn is rich in proteids, starch and fat. Corn bread, hoe cake, corn cake, are considerably used, in the southern states. Enormous quantities of shelled corn are used as raw material in the manufacture of alcohol, glu-

cose, oil, and starch. Corn starch is used in laundrying, in the manufacture of dextrin, as an article of diet, etc. Ground corn, from which the gluten or proteid matter has been removed, is known as oswego, maizena, or corn flour.

Corn (in the ear or shelled) is one of the staple foods for horses, hogs, cattle and poultry. Corn meal is fed to young fowls. The cobs form an excellent fuel and are often the only fuel used by the farmers of the prairie Western States. Corn stalks are used by farmers to form a protective thatching for sides and tops of sheds, etc.

In the cultivation of corn the farmer has to contend with various enemies. The army worm (*Lucania unipuncta*) has destroyed large crops. Smut (corn smut, a fungus) attacks the developing grain, often being the cause of poisoning cattle. The greatest enemies are the chinch bugs, which attack growing corn. Rats and mice often prove a nuisance to stored corn. As a rule, however, the corn crop in the central states east of the Mississippi is quite secure. It is well for pupils who are interested in corn to get in touch with the United States Department of Agriculture and with the State Agricultural Department and so get the bulletins.

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35. MISCELLANEOUS PLANTS.

PRIMROSE. *Primula vulgaris*. *Primulaceæ*.

These modest flowers are used solely for ornament. That they have served to inspire the poets accounts for their introduction here.

APPLE BLOSSOMS. *Pomum malus*. *Rosaceæ*.

Apple Blossoms are fragrant and are among the early orchard flowers. Every flower represents a possible apple.

CINERARIA. *Cineraria cruenta.* *Compositæ.*

Cinerarias are natives of warmer countries (Africa and southern and eastern Europe). They are easily cultivated in warm countries, but are house plants in temperate regions.

IRISH MOSS. *Chondrus crispus.* *Algæ.*

Irish Moss, one of many sea weeds of the Atlantic coast, is used as food, as sizing for felt hats and cotton goods, also for clarifying coffee, beer, and other drinks and as a bandoline, etc. In medicine it is much used as a demulcent.

CACTI. *Cactaceæ.*

Cacti are natives of America. They have thick fleshy stems usually covered with spines. The stalk itself, or the leaf-shaped stalk, performs the function of the leaf. Many have singular forms, some have most beautiful flowers, the beautiful night-blooming cereus is one of them. They are found almost exclusively in dry countries, usually in hot, stony and sandy regions, though the thick fleshy stem has stored within itself a quantity of water to be used during the dry season. In size they vary from small stems to trunks thirty to forty feet in height. The great melon thistle, or Turk's cap, looks like a green melon with green ribs set all over it. The prickly pear is grown for its delicious fruit. The nopal affords food for the cochineal insect. Luther Burbank has developed some spineless cacti which promises to make the arid regions of the Southwest and many other places habitable, as stock is very fond of this cactus and it can be raised in almost unlimited quantities. During the Texas drouth of 1902 many farmers burned off the prickles or boiled them soft and fed the plants thus prepared to cattle, thus saving their stock.

MISTLETOE. *Phorodendron Flavescens.*

The American Mistletoe is a parasitic plant growing on many kinds of trees, especially the apple and pear.

The leaves are yellowish green and the white berries are about as large as currants, being developed from small flowers. The berries have a sticky juice which helps to fasten them on the branches of trees where they grow. The American mistletoe closely resembles the European but is a different species. This plant, famed in mythology and folk-lore, is used for decorative purposes at Christmas time as an old tradition says the wood of the mistletoe was used in making the cross on which Christ was crucified, and that ever afterwards these plants were doomed to grow only on other trees. The mistletoe was also connected with many of the superstitions of the Druids; it was reputed to give the possessor the power of seeing ghosts, etc.

COTTON. *Gossypium barbadense.* *Malvaceæ.*

Cotton is an important annual plant from which the vegetable fibre of commerce is grown. The different varieties are natives of the tropical parts of Asia, Africa and America but are now grown far into temperate zones. The fruit is a three to five celled capsule springing open when ripe and containing many seeds wrapped in cotton fibre, one to three inches long, which constitute the cotton of commerce. The best is the long staple silk cotton known as Sea Island cotton, which is grown principally on the islands and coast of Georgia, South Carolina and Florida. The finest kinds of cloth are spun from Sea Island and Egyptian cotton. Cotton is also combined with silk, wool, linen or alpaca in the manufacture of certain kinds of goods. The most perfect system of cultivation is now used in the United States where most of the cotton of the world is raised. The seed is usually planted in March in furrows. Blooming occurs early in June, and picking usually begins in August and lasts until the frost stops further growth of plants. It is dried and ginned, or separated from the seeds, and packed ready for shipment. The process of separating seed from fibre was formerly done by hand but the invention of the

cotton gin by Eli Whitney in 1793 revolutionized the cotton industry. In this connection pupils should be taught the practical operation of the cotton gin. This simple machine was indirectly the means of perpetuating slavery in the South, as slavery was dying out before the cotton gin rendered the raising and manufacture of cotton such an important industry. In this connection also should be impressed upon the pupils the importance of Hargreaves' spinning jenny and Cartwright's power loom. Formerly the manufacture of cotton in the United States was confined almost exclusively to the New England States, but of recent years thriving factories for the coarser grade varieties have sprung up in the South and this industry is rapidly growing in importance.

Besides cotton fibre other by-products of the cotton industry are of great importance. Cotton seed is rich in oil, which is now extensively used in making lard and in other ways. Cottonseed cake is also used as a cattle food and the cottonseed meal is also becoming an important article of food. Pulp is now also successfully made from the cotton stalks, from which is made the finest of writing paper, etc.

PITCHER PLANT. *Nepenthes*.

The Pitcher Plant is a plant whose leaves form a cup to hold water. This peculiarity occurs in plants of widely different families. The water found in some of these pitchers may be rain which they have caught but others have their mouths so protected that no rain can enter so the water found there is secreted by the plant itself. The traveler's tree of Madagascar bears a large pitcher where thirsty travelers refresh themselves by piercing the pitcher leaf at the base. Six kinds of pitcher plants are found in North America, all but one being found on the Atlantic coast. Five varieties extend the range as far west as Minnesota but do not occur in the Mississippi valley south of the Ohio River.

SWEET FLAG. *Acorus calamus*.

Calamus, or Sweet Flag, is a reed-like plant found in Europe and southern United States growing in marshy places. It is an herbaceous perennial growing from spreading fleshy rhizomes from which spring the long sword-like leaves. Calamus has long been a popular remedy for various ills and has been used medicinally chiefly as a tonic and blood purifier, for which purpose the dried rhizomes are masticated and swallowed. It is used also in flavoring certain liquors. While calamus is no longer extensively employed in medicine it is still considered a stimulating, aromatic, bitter tonic.

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36. SHELLS.

Chart 36 illustrates various forms of animal structure for support or protection. In most of the cases here given the "shell" is external to the body, but in corals and starfishes it is imbedded in the skin. Children will understand how such shell is formed when they are led to realize that they are forming bone and muscle, all unconsciously, and when they are told that certain glands of the animal's skin secrete and deposit carbonate and phosphate of calcium, or mineral matter, in a way quite similar to their own secretion of perspiration or of tears. Sometimes, as in the starfishes, the lime is deposited as separate particles; among the snail-like mollusks this mineral matter takes the form of a single solid shell, while the clam-like forms have a shell of two separate portions. Whenever the outer tissues of the body are projected as frills or flutings, then will the shell take on a similar form; the color of a shell is caused by pigments being deposited along with the mineral matter. The outer tissue, or mantle, of nearly all mollusks has the power to secrete and deposit lime together with fibres of animal matter and more or less coloring matter. Wherever this mantle is of unusual form the shell will be similar;

thus arise the peculiar spines and roughenings of many shells.

Plate 1. Land snails have a lung and breathe air; they perhaps have two jaws but usually a long ribbon-like tongue, or radula, which bears horny teeth for rasping off bits of leaves or other material against which it is pressed.

Cochlostyla is a small snail living in the trees of the Philippine Islands. *Helix pomatia* is the edible snail of Europe, esteemed as a delicacy by epicures. In a dormant condition it is imported into the United States, in Chicago selling during the winter for 25 cent. per dozen.

Polygona is the common white-lipped snail of the United States, *Achatinella*, the large edible snail of the Pacific Islands.

Cerion is the beehive shell of the West Indies, and *Glandina* is a carnivorous snail, feeding upon other mollusks.

Plate 2. Starfishes belong to the branch of animals called *Echinodermata* (hedgehog skins). Their skin contains small interlocking but movable plates of lime and it may bear spines of various lengths. They are sluggish animals, a slow gliding movement being accomplished by means of hundreds of tubular sucking feet arranged in grooves along under sides of the rays. Portions of the body frequently are injured or broken off, but the remaining parts regenerate those lost, as shown in the middle forms. The series also shows the varying amount of connection between the rays. Starfishes, having relatively few enemies, are fairly numerous in all oceans, and are great pests among oyster beds; an oyster may close its shell but the starfish, placing its rays against the shell, slowly pulls it open and then devours the animal within. (See Bulletins 346, 729, 721, Bureau of Fisheries, Department of Commerce and Labor.)

Plate 3. These shells belong to mollusks which have a single large hatchet-shaped foot by which they draw

themselves through the mud and sand at the bottom of some body of water. Their shells are always of two parts, or valves. Because they live entirely within their shells they are compelled to eat only small particles which they can strain from the water; sometimes this food material is sewage and the flesh of the animal becomes contaminated. Almost all of these forms are edible, and their shells furnish material for buttons and inlaid pearl work; they form also the gems and pearls which are described in connection with plate 8.

The *Sunrise-shell*, *Tellina*, is marine, living in the sand along the Florida coast; it is one of the most beautiful of all molluscan shells.

Cockle of various kinds and sizes is found all over the world, in many places being an article of food.

The Mussel, *Mytilus*, often occurs in great beds in shallow water along the seacoast. While it is used as bait it is also especially esteemed by Europeans as an article of food.

The Fresh-water mussel, *Unio*, is common in the fresh waters of the United States and is familiar to every child. Under the nickname, "Prairie Oyster," it is eaten in certain localities. The shells of *Unio* and similar genera are largely used for pearl buttons and for ornamental pearl work. "Mother of pearl," or *nacre*, is the inner portion of the shell.

The Pearl Oyster, *Margaritiphora*, is marine; though widespread, the largest and best specimens are found in the Indian Ocean. (See Pearls.)

The Spiny Oyster, *Spondylus*, is similar to the oyster in habits and is found in similar localities.

The Scallop, *Pecten*, is a very common marine form.

The Oyster, *Ostrea*, occurs on our east coast from Labrador to Texas, the vicinity of Long Island furnishing the best specimens. Young oyster "seed" is bought and sold by the bushel measure, and is sown in some carefully prepared "bed" where the young attach themselves. At the age of about three years they are of marketable size and are gathered by tongs or dredges. (See Government Report.)

The picture of the Spiny Venus, *Cytherea*, best illustrates the work of another boring mollusk, the oyster drill, which perforates the shells of larger forms in order successfully to attack the animal within. The drill is a serious pest to oyster farmers.

Plate 4. The Rock shells pictured here are, with the exception of *Murex trunculus*, of no commercial importance unless it be as curios. *Murex trunculus* was the source of the ancient dye, Tyrian purple, the use of which was restricted to the royalty. It was prepared by crushing the bodies of the snails and, with some minor treatment, extracting the coloring matter.

Plate 5. The *Cephalopod* mollusks have either a coiled shell, as the nautilus and the argonaut, or they may or may not have an internal plate which is more or less limy. There is always a goodly number of tentacles bearing sucking discs, which serve in movement and in capturing food. The food is torn into bits by the beak and swallowed. Cuttlefish "bone" is given to house-birds and is carved by jewelers in executing designs with molten gold. India ink and sepia are colors, secreted by certain cephalopods for clouding the water when an enemy comes dangerously near. Squids are sometimes used as bait and are eaten in seacoast regions.

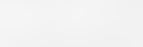
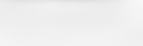
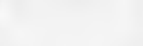
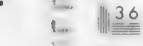
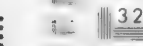
Plate 6. These marine snail shells are important merely as curios, though detailed information regarding them may be found in "Shells of Land and Water" and in "The Shell Book."

Plate 7. Almost all of the species shown here are common forms throughout the United States and several are of almost worldwide distribution. They breathe air at the surface of the water; their eggs are deposited in jelly-like masses attached to submerged leaves and stones. These snails do a great work in nature, devouring refuse of all kinds, thus aiding in keeping the water clean. The whorls turn to the right, except those of *Physa*, which is a left-handed form.



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Plate 8. The coral pictured here is formed by the growth of many small flower-like polyps which secrete lime (calcium carbonate) in their outer tissues. Each polyp grows slowly and adds but little material to the whole, but slowly the stems elongate and branch. When the polyps die the mineral matter is left. This is compact and capable of being highly polished. A coral animal is not an insect, for it has a simple body without legs, wings, head, or eyes.

Pearls of perfect form are generally found in the pearl oyster of warm oceans; freshwater pearls are often imperfect and are called "slugs"; their value is not great. In any case, some foreign object has lodged between the shell and the delicate tissue of the oyster or clam; this causes irritation just as a cinder does in the human eye, and the animal covers the object with delicate layers of lime, gradually increasing the size of the pearl. The center of these pearls is very often a small parasitic worm, or it may be a grain of sand or even one of the animal's own eggs. In the Indian Ocean, pearl oysters are obtained by native divers. The day's catch is tied in sacks, piled on the beach and without close inspection bought by brokers. After the oysters have been allowed to decay the sacks are opened and the contents washed in troughs of water. Natives, sitting naked beside the troughs and under close guard, squeeze the mass through their fingers. The animal matter is thus washed off and the remaining pearls removed and sorted. Those of best quality and largest size are used in jewelry while the very small ones are used by Chinese physicians who burn, or calcine, them and prescribe them as a mild alkaline remedy.

Jade is a very hard and tough mineral, of somewhat glassy composition and texture which was formed in the heated interior of the earth. Since prehistoric times it has been much used by man for ornamentation because of its beautiful color and its durability.

Chrysaberyl is a very rare gem, which, when polished, is the "oriental cat's eye."

Plate 9. *Haliotis*, the abalone or ear shell, is found in various parts of the world, but its greatest size and beauty are attained in the region of California. It is the source of the beautiful mother of pearl used in inlaying musical instruments and other valuable articles. The Indians and Aztecs restricted its use to royalty. The animal inhabiting one of these shells is considerably larger than the shell, a large fleshy disc attaching it to the rock; irregular frills and tentacles, some of them bearing eye-spots, project from the surface, while water from the gills and waste pour through the perforations in the shell.

Crepidula, the slipper shell, or limpet, and *Fissuridea*, the keyhole limpet, are in habit similar to *Haliotis*, but their range is greater and their size smaller.

Turbo is the turban; *Nerita*, the bleeding tooth; *Harpa*, the harp; *Bulla*, the bubble; and *Cerithium*, the horn shell.

Mitra pontificalis bears a more or less fancied resemblance to the pontifical mitre, or pope's cap.

Strombus, one of the conchs, is frequently used for carving cameos, the shell layers of varying hues adapting it to this work.

Littorina, the common periwinkle, is used in Europe as food, the fleshy animal being picked out with a pin; it is also used as bait for fishing, and when "planted" on oyster beds it keeps them clear of seaweed.

QUESTIONS.

1. How many shells like those in this chart have you seen? How many different kinds do you think you could find?
2. Where would you look for them, in the dry fields, the woods, the marsh, or in ponds and creeks?
3. Which shells are largest and heaviest, those from the oceans, those from the fresh waters, or those from dry land? Can you find a reason for their size?
4. In what countries and what parts of the world are the most beautiful ones found?

5. Are their colors like or unlike the surroundings—are snails hard or easy to see at a distance? Are the creatures conscious of their colors? What are the most common colors?

6. What are some of the nicknames given to various shells? Why?

7. How many separate pieces in a snail shell, a clam shell?

8. Do most snail shells turn like the clock hands, or the other way? Why are the outer turns largest? Where in the shell was the baby snail?

9. Do clam shells or snail shells most completely enclose and protect the animal?

ADVANCED OR EXTRA TOPICS:

1. "The Chambered Nautilus"—Holmes.
2. "Clam fishing"—"Clam bakes"—"Clam chowder."
3. A private collection of shells, belonging to the pupil.
4. The story of the pearl industries.
5. The story of the pearl button industries.
6. The development of a baby clam.
7. The development of a baby snail.

H. B. S.

37. INSECTS.

On chart 37 are pictured insects of various kinds. It will be recognized that all of them have a body which is somewhat elongated and which is made up of three portions, the head bearing the eyes, the feelers or *antennæ*, and the mouth structures; the second portion or thorax bearing the legs, of which there are always three pairs, and the wings, of which there are almost always two pairs; while the third part of the body, called the *abdomen*, usually bears no very well marked structure.

The kinds of insects illustrated upon the chart are the *Lepidoptera*, or moths and butterflies; the *Coleoptera*, or the beetles; the *Orthoptera*, or grasshoppers; and the *Hemiptera*, or true bugs.

Plates 1, 2, and 3 illustrate butterflies, while 4, 5, and 6 illustrate moths. Some pupil may ask what is the difference between a moth and a butterfly. Some of the differences can be explained by the pictures. The butterflies generally have rather slender bodies while those of the moths are more bulky; the antennæ of the butterflies are generally thread-like with knobs on the end. Out of doors children will find that butterflies, when they rest, hold the wings upright over the back while the moths generally keep the wings outstretched. It is quite generally true also that butterflies are active by day (*diurnal*) while moths are, for the most part, active by night (*nocturnal*). When the child is told that the antennæ of an insect may serve not only for feeling, but for smelling and hearing, he will appreciate why the moths' antennæ are so very much larger than those of the butterflies. Owing to the great beauty of many of these creatures, they have been widely collected and perhaps are the first to appeal to the collecting instinct of the boy or girl. The forms pictured here are but a very few examples which have some practical interest.

In Plate 1 the two forms *Papilio* are examples of the large group of "Swallow-tail Butterflies," various members of which are found throughout the United States and Canada. The forms *Terias* are "Small Sulphur Butterflies," the *nicippe*, common in the United States south of the Ohio River, while *Mexicana* occurs in the southwest and in Mexico. *Meganostoma* is the "Dog-face Butterfly" common on the Pacific coast. *Colias*, in this plate, is one of the "Clouded Sulphur Butterflies" which is common throughout the United States east of the Rocky Mountains in meadows, fields, and roadsides; it develops from a small green caterpillar which

is frequently found on clover. *Junoiana* is a "Peacock Butterfly" which is very common in the Southern States and even as far south as South America. *Limenitis* is a "Red-spotted Purple Butterfly," a common form recognized by the blue spots on the upper side of the black wings and by the red spots underneath.

Plate 3. *Argynnis* is the "Ruddy Sulphur-spot," common in the northern United States in late summer; it is distinguished by its rather large size, its ruddiness above, and its numerous spots of sulphur on the under side of the wings. *Vanessa*, the "Mourning Cloak," is usually about $1\frac{3}{4}$ inches in breadth and is common throughout the United States. The caterpillars of the Mourning Cloak are commonly found on willow, elm, or poplar trees. *Danais* is the "Monarch" or "Milkweed Butterfly" which is common in the northern United States; it perhaps deserves especial mention because it is one of the few insects which migrate in the fall and spring. On sunny days of late summer many a boy and girl has noticed large numbers of these butterflies clustered thickly upon the branches of trees along the roadsides or in the weeds where they are gathering together for their fall migration southward. They have even been met with several hundred miles out at sea. The return journey in the spring is not made by members of one generation but the first generation, reaching the southern United States. The product of these eggs flies northward considerable distances and again reproduces and dies. This accounts for the appearance of these butterflies in large numbers in the region of Wisconsin and Michigan only during August and September, for they are the third or fourth generation. *Phyciodes*, the "Northern Crescent-spot," is common in the northern United States as far west as the Rocky Mountains. *Pieris*, or *Pontia*, is a common "White Cabbage Butterfly"; the northern species is *rapæ* and the southern, *protodice*. *Colias* is one of the sulphurs; *Debis* is the "Pearly-eyed Nymph," a woodland form which is rare

west of the Rocky Mountains. *Meganostona sasonia*, the "Southern Dog-face," is usually about $2\frac{1}{4}$ inches broad and is found in the southern states. *Pyrameis huntera*, "Hunter's Butterfly," or Painted Beauty, is usually about 2 inches broad and is found east of the Sierra Nevada Mountains.

Plate 2 illustrates what is known as the "Dead Leaf Butterfly" of India, where it is very common. The lower figure illustrates the insect as viewed from above with its wings outstretched and the upper right hand figure shows the same butterfly with its wings folded over its back so that the under surfaces only are seen. The very close imitation of a dried brown leaf is the animal's protection, for it escapes notice through this specialization of color and form. While it illustrates such protection very well there are equally good examples in every locality if the boy or girl has eyes to see them. It must not be supposed that the butterfly in this case has calmly seated itself upon some branch, scratched its head, and calculated that if it should only imitate a dead leaf closely it would save its life and, having so concluded, straightway has changed itself and arrived at the present condition. On the contrary it seems much more probable that in preceding generations some individuals happened to look somewhat like a dead leaf and thus escaped notice while the brothers and sisters were eaten by the birds or lizards. The ultimate result has been the reappearance and the fixity of this form and the non-appearance of any other. We are all familiar with examples of such variation in a brood of chickens, a litter of kittens or puppies, or even among the children in a human family.

The moths pictured in plate 4 are fairly common throughout the United States while those in plate 6 are more especially eastern forms. *Luna* is the "Moon Moth"; *Polyphemus*, one of the American Silk Moths. It might not be amiss for the teacher to tell his classes the

old Grecian story of Polyphemus, the one-eyed giant who lived in a cave. In one of the fables in which he appears he confined a crew of shipwrecked men within his cave, intending to eat them one by one, but while Polyphemus slept, Ulysses plunged a burning stick into his eye. The leader and captain, Ulysses, then tied each of his men to the under side of one of the giant's sheep and turned the sheep loose and started them out of the cave. The giant stationed himself at the entrance and passed his hand across the back of each sheep as it ran out, expecting to find a man riding out. But the thongs had sunk into the sheep's wool and the men escaped in safety, Ulysses clinging to the belly of the last sheep.

Promethea, the Spice-bush Silk Moth, emerges from cocoons which, unlike most others, are found hanging from twigs. *Cecropia* is one of the gaudiest of the moths; emerging from its cocoon in the early spring, it often startles an observer into the belief that he has made a great discovery. Such a "scientist" sees only a big barn door.

In plate 5 the story of the silk moth is illustrated together with something of the manufacture of silk. The eggs deposited upon mulberry leaves hatch and grow for several weeks as caterpillars or silk worms. They then spin about themselves the cocoon by turning their heads from side to side and upward and backward so that there is drawn from certain glands near the mouth a continuous thread of sticky material which hardens in the air as it is wound about the worm and forms the cocoon. The thread is unbroken from the beginning of the manufacture of the cocoon until it is finished. Then it is several thousand feet long and is unwound from the cocoon after immersion in warm, soapy water. By this means the pupa within is killed and the gum that holds the thread in place is dissolved. After the fibres from several cocoons are unwound they are carded into loose skeins of silk. These skeins, after passing through many delicate processes, finally appear as finished threads or

cloth of silk. In but the single thread of *A* silk there are about 150 original worm filaments, the average length of each one having been 3,150 feet, or more than one-half mile.

Plate 7. Beetles (Coleoptera) are the most easily distinguished of all insects inasmuch as their bodies are almost entirely enclosed within a hard shell. The outer pair of wings carry out this armor-plate idea, being inflexible and usually shiny. In taking up the species illustrated in the order of their occurrence in the picture more than a word regarding most of the forms cannot be given here; such would be the work of a technical treatise. All of those forms figured in the first row across, with the exception of *Brenthus*, belong to the large group of hunting beetles which, in both the adult and larval stages, prey upon other insects. *Libia* preys upon potato "bugs"; *Alaus*, the "Eyed Elater," has the startling habit of clicking its thorax against the abdomen and thus snapping itself away from its captor. Its larva bores in wood. The other forms pictured in this row are predaceous *Necrophorus*, being called "Burying Beetles," or "Tumble Bugs." In the next series, *Calosoma scrutator* is called the "Searcher," or "Caterpillar Hunter," because of its nocturnal habit of hunting and feeding upon the hairy caterpillars found upon foliage. *Calosoma calidum*, is the "Fiery Hunter." *Cotalpa* is the "Goldsmith Beetle," feeding, for the most part, upon foliage. *Cychrus* is another of the hunters. In the last series *Lucanus* is the "Stag Beetle" of the South; its food is the sweet sap of trees and the honey dew of certain plant lice. *Cynastes* should be named *Dynastes*; it is the "Rhinoceros Beetle" of the South; it is a burrowing form which feeds for the most part upon animal tissues. The horned *Passalus* is similar in habit to the *Lucanus*; it is one of a number of so-called "Pinch Bugs."

Plate 8 illustrates just a few of the common and important locusts or so-called "grasshoppers." They are

not grasshoppers, strictly speaking, because their habits do not confine them to grasses and because, perhaps, the antennæ or feelers are comparatively short; at least they are not nearly so long as the body. True grasshoppers are usually found in tall grass, they are usually green in color, and their feelers are very long and delicate. *Hippiscus tuberculatus*, commonly called the "Coral Wing Locust," or the "King Locust," is abundant in the central part of the United States; it is one of those forms which make a loud rattling noise while flying. *H. neglectus* is another species of the same genus. *Melanoplus differentialis* is a very common form in the southwestern United States; the body usually is brown to yellow, the fore wings being without spots and the hind wings clear. *Arphia tenebrosa* is a western form having the hind wings coral red at the base; in the East it is replaced by the *A. xanthoptera*, whose hind wings are yellow instead of red. *Schistocerca americana* is the "Great American Locust," more abundant in the South; while not inflicting so much damage as the notorious Rocky Mountain locust, it does its fair share of work and is migratory in habit.

In this connection it might not be amiss to tell the classes something of the scourge of locusts which have appeared in various places at various times. To pass over the more remote accounts such as those given in the Old Testament and those described by Darwin in his "Voyage of a Naturalist Around the World," we might tell of the great plagues which visited the western states in the years 1866, 1874, and 1876. It is very probable that there are many members of every community who recall these disasters and possibly some who had personal experiences in them. Locusts had been breeding in the upland country along the foothills of the Rocky Mountains and had increased until all vegetation had been devoured and nothing was left to satisfy hunger. The insects rose into the air until the air currents caught them and blew them eastward over the plains where they dropped down. There were countless millions of insects

and they devoured every green thing in sight; the crops in the fields, the foliage, and the bark on the trees were eaten. The noise of their munchings was very audible and when in flight their enormous numbers shut out the sunlight just as a cloud would do. It needs no imagination to picture the disaster and ruin which would follow an event like this.

Dissosteira carolina is the common "Carolina Locust" found throughout the United States and Canada; it is easily recognized by the black body and the black hind wings with their yellow margins. This insect, to the author's personal knowledge, is becoming a great nuisance, and is destined to inflict great damage upon the country before the farmers awake to the situation; we usually do not lock the stable until the horse is gone. Birds are its natural enemies. This locust, in both the mature and the immature forms, feeds upon raspberries and other small fruits, as well as upon grasses, corn, wheat, etc. In one specific instance it riddled a brand new coat which a boy had forgotten and left in the field from Saturday night until Monday. The children of almost every class can add instances of the work of the so-called grasshoppers.

Plate 9. On this plate are illustrated types which are known to scientists as true bugs. To the one who has not delved into the mysteries of insect life and form, any flying creature without feathers is a bug; the coral polyp even has been given the name of insect. As an order of insects, the bugs are distinguished by having their two pairs of wings of quite similar structure, to a certain extent at least, rather thin and membranous, and by their possession of mouths well adapted to piercing tissues and sucking juices. Because of this habit and their enormous numbers, they have become the most injurious of all the insect orders. Examples of bug pests are the chinch bug, which annually devastates thousands of acres of field and garden crops in the United States; the grape phylloxera, which caused the ruin of vast and rich vineyards

in France, and disaster to thousands who were engaged in the various branches of the wine industry; and the San Jose scale, whose effects upon the fruit orchards of the Pacific coast, and more recently upon those of almost every state in the Union, are well known. The beetle is not a bug, because his outer wings are hard and sheath-like, and because his jaws are fitted for chewing. The teacher should point out to the class the differences between the bugs and the other orders illustrated here.

Because on plate 9 the forms are not named, let us give them numbers from one to twelve counting from left to right in the successive rows. Number 1 is *Archimerus calcarator*, a relative of the squash bug and the box elder bug, two forms which are highly injurious through their habit of piercing the soft tissues of plants and withdrawing the sap, to the detriment or destruction of the plant.

Number 2 is a tree bug, *Nezara nilaris*, which is found in the South upon orange trees; it is a true pest and is one of the numerous "stink bugs."

Number 3 and number 5 are leaf-footed plant bugs, the first being *Metapodius femoratus*, the cherry bug, and the latter, *Leptoglossus phyllapus*, a form affecting oranges, while a northern form injures melons and garden stuffs.

Number 4 is *Oncopeltus fasciatus*, a milkweed bug which is a close relative of the "Cotton Stainer," a particularly obnoxious insect in cotton fields, where it stings the growing cotton boll thus checking its growth and later, as the boll is opening, stains it with its excrement.

Number 6 is *Conorhinus sanguisuga*, one of the types commonly called "assassin bug" or "kissing bug"; in the South it sometimes enters houses and pierces human flesh, injecting into the wound its own saliva; this causes a painful swelling. The young are sometimes found in the crevices in the walls and floors, covered with dust which adheres to the sticky surface of their bodies and enables them to steal upon their prey unseen. They are

called "bedbug hunters," and they do great benefit by attacking other insects which are injurious.

Number 7 is the "Water Scorpion," *Ranatra*, a "beast of prey" which is found in the mud and weeds of shallow water; it attacks other animals. Its form and color are protective.

Number 8 is *Benacus griseus*, the "Giant Water Bug," a common aquatic form which is very ferocious in habit, not hesitating to attack turtles and fish. At night it frequently leaves the ponds and flies about, often being attracted by lights; for this reason it is sometimes called the "electric light" bug. It is one of nature's scavengers and also one of her means of keeping the animal population in check.

Number 9 is *Cicada septendecim*, the "Seventeen Year Locust," distinguished as in the picture by the red veining of the wings. This insect deposits its eggs in slits in the bark of young twigs. The eggs hatch within a few weeks, the young forms drop to the ground and burrow some distance until they can feed upon the juices obtained from various plant roots. Every two or three years they molt. In the spring of the seventeenth year they crawl to the surface of the ground, up upon some support where the skin, or "shell," is cast off; the adult insects now spread out their wings to dry and fly away. A similar form which develops in two years is found in the North, where it is called the "Harvest Fly"; its strident song is common in the days of late summer.

Number 10 is the "Toad Bug," *Galgulus*, which occurs in water and feeds upon the blood of animals either dead or alive.

Number 11, *Platycotis*, the "Tree Hopper," is one of a large number of little brown bugs which are very common upon the bark of trees, where their color and their form protect them. They are sap feeders but are held in check by such birds as the creepers and nuthatches, which make it a business to hunt them.

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38. VERTEBRATES FISHES AND REPTILES.

Here are depicted members of two of the lower groups of vertebrates, Fishes and Reptiles. The group of fishes, while a very large one and including many very different forms, has certain characteristics distinguishing it from all others. The entire life of a fish is spent in the water; it has fins; fingers and toes never develop; and it undergoes no marked changes which would tend to simplify its structure. This statement explains why a tadpole is not a fish. Many creatures which by fishermen or sailors are frequently miscalled fishes, really have no claim to be so named: a seaman calls any animal which lives in the water a "fish"; as cuttlefish, devilfish, shellfish, etc., etc.

Reptiles, as a class, are marked by the scaly covering of the body, the possession of five toes on the front foot, which a toad does not have, by the omission of any tadpole stage after hatching, and by certain internal structures.

Black Bass. The large-mouthed black bass is one of the members of a very large family which includes, among others, the common sunfish. The bass ranges throughout the United States and Canada east of the Rocky Mountains. One of the game fishes highly prized by amateur sportsmen, it is found under varying conditions; it seems to prefer small lakes of considerable depth, cool water, and a bottom only partly muddy. Its average weight is from three to four pounds, though it may far exceed that weight. It is being reared artificially by various fish commissions and the United States Bureau of Fisheries to be distributed to various localities, for its value as game fish and an article of food is such that it is well called one of our national resources.

Sunfish. The common sunfish is the first acquaintance of the amateur piscatorial artist. Every boy has had experience with "the pun'kin seed," even if it were

only while dangling a bent pin upon the end of a string from the side of a bridge or some overhanging tree. Its range is almost as great as that of the black bass but its weight seldom exceeds one-half pound. Summer resorters at our northern inland lakes have noted the exemption of the sunfish and its near cousin, the blue gill, from the ravages of certain parasitic worms which sometimes ruin the bass and certain other fishes for table purposes. These worms are to be found close under the skin and the sportsman is urged to look before he eats.

Muskalunge. The muskalunge ranks first of the freshwater game fishes. The northern species occurs in waters tributary to the Great Lakes, while the southern species, the Chautauqua muskalunge, is found in waters tributary to the Ohio River. Its weight sometimes reaches 100 pounds or more, and its length, $7\frac{1}{2}$ or 8 feet. It feeds upon smaller fish and is usually caught by trolling.

Garpike. The long-nosed garpike is a true sport. Its elongated body, pelvic fin set well back toward the middle of the body, the single dorsal fin placed near the tail,—all indicate great ease and rapidity of movement. The long jaws with their strong teeth make the possessor a terror to all comers. The scales of enamel and the armored head attempt to make up for the soft places which exist in the internal skeleton. By its ample protection it survives and multiplies; because of its ferocious habits it has become a serious plague. It is rapidly spreading into northern streams where it exterminates smaller but more valuable fish. As an article of food this fish is valueless but to the scientist it is an object of great interest. It forms a transition link between the simplest fishlike forms which have only a cartilaginous skeleton and the true fishes with their skeletons of bone. The form of the tail, with the slight curvature of the backbone upward into it, is an indication of a primitive condition; in other words, it is a half-old-fashioned tail; the garpike is to-day one of the remnants of a very large fish

population which once inhabited the globe. Fossil remains of similar fishes are found imbedded in rocks high up on mountains or buried deep beneath overlying strata of great thickness.

Trout. The illustrations of the trout, with small changes in form and color, might very well serve for the salmon, either the Atlantic or the Pacific forms. The brook trout is one of the gamiest of the fresh-water fishes, occurring in the northeastern United States and eastern Canada. It has been almost wiped out of existence because of the ravages made by the "fish hog," a degenerate type of the genus man. The rainbow trout is a western form occurring upon the Pacific coast. Both of these forms are high spirited and to be caught only by the exercise of great tact and good tackle. The scales of the trout are usually very small and the flesh of the mouths so soft that the animal can not be lifted directly from the water or pulled or yanked in when first caught. It must be "played" until exhausted and then landed with a small hand net. The flesh is of a rose pink color and of a remarkably delicate flavor. As a game fish, in all points except size, it surpasses the muskalunge.

QUESTIONS.

1. Where do fishes live, in salt or fresh water?
2. Name as many different fishes as you can and tell what each one is used for or give some interesting fact about it.
3. How do fishes move from place to place? What particular work does each fin or pair of fins do?
4. On the sunfish, why do you suppose some of the fins are bony and others soft? What does the fish do with these bony fins when you try to take hold of it?
5. How is the tail of the garpike different in form from the tails of the other fishes?
6. How many top fins has each kind of fish and where are they placed? Of what use would this be to you in distinguishing the kinds of fishes?

7. What do fishes eat? Have they teeth? Do you suppose they chew their food or swallow it whole?

8. How do fishes breathe? Is there air in the water?

9. Are young fishes born or hatched? How many baby fishes does a mother fish have? What are some of the names given to young fishes?

10. Describe some fishing expedition which you have made.

11. Name some of the substances manufactured from fishes.

The teacher is urged to tell to the class the story of the salmon and the eel and some of the details of various fishing industries such as cod fishing and sword fishing, and to describe or illustrate some of the various forms of nets used by fishermen. References:—Hornaday: "American Natural History"; Jordan and Everman: "Fishes of North America"; various bulletins of the Bureau of Fisheries, U. S. Dept. of Commerce and Labor.

The remaining forms pictured on chart 38 are all reptiles; the snapping turtle belongs to a group which is characterized principally by the possession of a shell while the other forms are lizards which have a scaly skin, four limbs, and a tail of varying length.

Horned Toad. The horned toad, wrongly named "toad" for the reasons just enumerated, is a very common type which inhabits the arid sandy regions of the southwestern part of the United States from Texas to California and southward into Mexico. Its color resembles the mottled sand and is variable to less extent than the northern tree frog. When resting it digs its way down into the loose sand, perhaps entirely concealing itself or perhaps thrusting its head out as far as the circlet of spines around the neck. It feeds upon various insects and creeping things which it catches and swallows entire. It is a very interesting little pet but it can with difficulty be carried through a northern winter.

Gila Monster. The Gila monster (pronounced "hēla"), a gaudy lizard approaching a length of two feet, is found in southern Arizona and northern Mexico. It is said to be the only lizard whose bite is poisonous but there are no authentic cases of its being fatal to man.

Collared Lizard. The collared, or kangaroo, lizard inhabits the same district as the horned "toad" and lives in much the same manner. It has a peculiar habit of rising upon its hind legs and running fairly rapidly. In length it may vary from four to ten inches; the average size of the horned toad is slightly smaller than that of its picture. Many of the long-tailed lizards are able to disjoint their tails near the body when suddenly alarmed. The author recalls no more disagreeable experience than when one of them, a pine lizard, suddenly jumped away leaving a wriggling tail in his fingers. To an animal who had expected a dinner this would certainly prove a disappointment. Any of the lizards make interesting pets if the proper food can be provided, for naturally all reptiles catch their food alive. It frequently happens that they must be fed by force, the food being placed far back in the mouth with a pair of tweezers or the end of a toothpick. The presence of an object at this point causes swallowing to occur involuntarily.

Snapping Turtle. The snapping turtle is common throughout the United States, especially in the eastern part, and is the object of a mysterious respect of every boy who ever went swimming and of every girl who ever waded barefoot in the millpond. The story has it that this beast is particularly fond of bare toes and does not let go till the sun goes down. It is frequently caught by fishermen on a hook and line. If you ever caught an "old settler" you probably found him with his back covered with moss and his temper about as ugly as could possibly be expected in an animal which is supposed to have a brain but no brains.

QUESTIONS.

1. Describe some of the turtles which you have seen or know about. What color were they? How large? Where did you see them?
2. How do turtles get around when in the water; when on land? What do they use their tails for?
3. What do turtles do in the winter time?
4. What do turtles eat? How do they eat? How many teeth have they?
5. Can the turtle keep its eyes open in the water? Has it any eyelids? Does it ever sleep? Has it a nose? Has it ears? If so, where are they?
6. How much of the body does the shell enclose? Can all of the body get under the shell at once? Is the tail drawn into the shell or wrapped around to one side? How much weight can a good big turtle support?
7. Are turtles good to eat? If so, how are they prepared? What is tortoise shell? Tell all you can about its preparation and use.
8. What do you know about young turtles; their birth or hatching; the number of them in a family; and where they are to be found?
9. How fast do turtles grow? How old do you suppose the turtle in the picture would be?

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39. HOOFED ANIMALS.

The Hoofed Animals, called *Ungulata*, are those whose toe nails are strongly developed for protection and support. They are of many widely differing forms and they occur in just as widely differing localities. There is the small piglike creature, the peccary of sub-tropical America, the camel of the desert, the bighorn of the mountains, and the reindeer of the frozen north. In size ungulates vary from the tiny hyrax (Chart 43) and the domestic pig to the elephant. No other group, perhaps, illustrates so well as does that of the hoofed animals diversity of

structure which may result from peculiar habits of life. There are many divisions and subdivisions in the group, perhaps the most important one being the classification of even-toed and odd-toed forms, the pig, the cow, and the sheep being even-toed, and the horse, odd-toed. The presence of antlers or horns is a striking characteristic of many of the group, as is also the fact that they are all almost strictly herbivorous.

The horns or antlers are of two distinct types. Those of one are hollow; they are constantly growing at the base and are never cast off. Such horns are usually marked by rings or lines of growth like those of a clam shell or of a tree. The other form of horn is solid and is cast off each year, being replaced very quickly by another and larger one. This form is usually marked by being forked or pronged, and the age of the animal is accurately told by the number of prongs or "points" present in the antler. These horns are spongy at first and while growing are penetrated with a very elaborate system of blood vessels, are richly nourished, and are covered with a delicate skin or "velvet." Within a few weeks after the shedding of the old antlers, the tissues of the new ones harden; constrictions occur at their bases which cut off the blood supply and the vitality of the horn, so that the velvet then comes away from the surfaces. This annual shedding of the antlers is an expensive process and it greatly affects the animal's physical condition and disposition at the time.

PRONG-HORN ANTELOPE.

The Prong-horn Antelope is found in the region of the Missouri River and westward and from northern Canada south to Mexico. It travels in herds except during the summer, the time of the rearing of the young. It is extremely swift on foot and timid of disposition, though its curiosity often impels it to investigate some such unusual object as a handkerchief raised upon a gun-rod by a wily hunter who is lying in the grass. These animals are usually about four and one-half feet long and nearly

three feet high at the shoulder. When seen from the side their color harmonizes very closely with that of the prairie; but when seen from the rear the patches on the rump are very conspicuous; these rump patches are supposed to be signals visible when the animal is in flight. The horns, while similar in form to those of the cow, are shed and renewed every year. The animals, though difficult to keep in captivity, are said to be satisfactory pets.

ALASKAN MOOSE.

The Alaskan Moose is the largest member of the deer family. The American moose ranges from New York and Maine northward and westward through Canada and across the Montana line into Minnesota, Dakota, and Montana. In spite of the enormous antlers the moose is a creature of the woods; it browses in the thickets surrounding woodland lakes and wades out into the shallow water to feed upon lilies and similar edible plants; for such habits the long legs are well adapted. These animals are nearly always hunted during the rutting or mating season; the hunter imitates the call of the cow moose by the use of a birch bark trumpet. In winter the animals travel in groups of three to six; the company is a polygamous family composed of the old bull and two or three cows with their young and possibly their yearling calves. They may go from place to place feeding upon young twigs or such herbage as they can expose by scraping away the snow, or they may remain in a sheltered wood or thicket, called by hunters the "moose yard." The antlers of the moose are palmate, or shaped somewhat like the palm of one's hand; the nose, or muzzle, is soft and flexible; in fact, is almost prehensile; the feet are cloven like those of the cow. These animals are much sought after by hunters but they deserve preservation similar to that now afforded the American bison and the deer. The protection of the deer in Maine has resulted in their becoming far more numerous than they were when the white man first entered the country. This

means that many hunters are afforded profitable recreation, who, without the existence of game laws and the legal protection of wild game, would be compelled to forego the pleasures of hunting under almost primitive conditions. The moose will probably get protection at the eleventh hour.

THE AMERICAN ELK, OR WAPITI.

The American Elk was first so-called because of its general resemblance to the European elk, which is in reality, a close relative of the moose; it is not, however, an elk, for, as the illustration shows, the antlers are not palmate. It would then be more correct to insist upon naming this form the wapiti. On account of its size it has been called, "The King of the Deer"; it is a member of the deer family, the antlers being present only upon the male and being shed annually. It formerly ranged throughout northern United States and Canada and southward in mountainous districts but it is now extinct except in remote regions of the West. Its average height at the shoulder is about five feet and the antlers themselves are usually about five feet broad. It is at home on the plains, where it browses in the open country, or in the woodland, where it feeds upon young twigs and herbage; it is one of the easiest of the deer to keep in captivity.

After the pairing season, the wapiti assemble in constantly enlarging herds, finding it to their mutual protection to travel and browse in large companies. While such a herd is browsing, the patriarch usually ascends some knoll and acts as a lookout, with his shrill whistle warning the others of approaching danger. This habit indicates a fair development of the social instinct, for there must be present the faculty for leadership in the male and the conscious willingness of the other animals to be led and guided. The antlers are usually dropped in the spring and within three months the new ones have attained full size once more. The fawn is usually born in April when food is abundant. Many stories are to

be related regarding the habits of the wapiti and the fierce struggles between males for leadership. Such rivalry is very widespread among animals, for almost all show it. Where it does exist, the males usually have attained greater size and strength than the females, for their struggles to gain and retain the leadership of even a small herd is severe and only the largest ones can be successful. This great size has also resulted in the habit of one male retaining as mates more than one female. Such a relationship is called polygamy. Among animals which practice monogamy, the male and female are scarcely different in size.

While discussing with the class the three types of deer illustrated on this chart, the teacher should digress and take up the members of the family which are of more or less importance to man, such as, for instance, the common Virginia deer, the caribou, and the reindeer; also the subjects of protection of wild game by game laws or by closed preserves; the value of game to a state as a source of revenue and of recreation. The reindeer in its particular locality is of far more importance than any other of our deer in theirs, for it is a source of food, of clothing, and a beast of protection and burden. Without it the Laplander could not exist and vast stretches of territory would be uninhabitable by man. Doubtless the instructor knows something of the recent efforts of the American government to introduce reindeer into Alaska, their first failure and their ultimate success. Reindeer are now being used for carrying mail and for hauling provisions; their milk and flesh are standard articles of food.

THE AMERICAN BISON OR "BUFFALO."

To the world at large, the Bison is probably the most famous of American animals. Its large size and massive appearance, its enormous numbers, and its value as a source of food and clothing have contributed to its fame and also to its extermination, for no hunter is ever content to hunt small game if large is to be found. The

bison should be distinguished from the buffalo, which is found in Africa and Asia, in that it possesses a marked hump on its shoulders. In habits it is similar to the domestic cow, for its tooth structure, its feeding habits, such as browsing and cud-chewing, and its general anatomy are closely similar to that of the domestic animal. At the present time there are perhaps fifteen hundred buffaloes in captivity in various public or private collections, but as recently as 1880 they existed by the hundreds of thousands in the western plains and mountain valleys. The following extract from Hornaday's "American Natural History" will give an idea of the enormous numbers which at one time existed in the United States:

"It is safe to say that no man ever saw in one day a greater panorama of animal life than that related by Col. R. I. Dodge, in May, 1871, when he drove for twenty-five miles along the Arkansas River, through the unbroken herd of buffaloes. By my calculation, he actually saw on that memorable day nearly half a million head. It was the great southern herd, on its annual spring migration northward, and it must have contained one and one-half millions. In those days mighty hosts of buffaloes frequently stopped or derailed railway trains and obstructed the progress of boats on the Missouri and Yellowstone Rivers."

The average height of these animals at the shoulder is somewhat less than six feet; the females are usually much smaller than the males, for the animals are polygamous. At the breeding season they formerly gathered in enormous herds and all was excitement, owing to the conflicts of the various bulls. During the winter they migrated southward and in summer northward.

The mating season was in the fall, when the bisons occupied their southern feeding ground; the pairs remained in the company until the spring, when the cows went off by themselves to the most sheltered spots they could find and gave birth to their calves. The latter grew rapidly and were soon able to follow their herd, though still jealously cared for and defended from all

dangers by their mothers. The old bulls, in the meanwhile, had congregated in herds by themselves.

In order to escape the attacks of flies and other insects, they sought out muddy sloughs and shallow ponds where they could roll and wallow to their hearts' content and emerge with their coats filled and plastered over with clay; this soon baked in the sun and formed a hideous but most effective armor which would last for days.

Doubtless this account will reach persons who have had personal experience with the buffalo of the past, who know something of the value of its flesh for food and of its hide for storm-coats and lap-robies, of its horns for powder horns, and even of its chips for fuel. It is said that the flesh of the buffalo cannot be distinguished in flavor from that of the domestic cow, though it is somewhat tough.

QUESTIONS.

1. What is the general color of the buffalo and what special marking has it? 2. How do its head and shoulders in size compare with those of the cow? 3. Do you think the buffalo would be a good runner; a good fighter? How would it protect itself from wolves and other enemies, by the use of its horns, by a blow with its head, or by striking with its feet? 4. Where on the body is the hair thickest? Do you think the buffalo would face a storm or turn away from it? 5. How long is the buffalo's tail? Of what good would it be? Do you think buffaloes would be badly affected by gnats and flies? 6. How much of the sole of the foot is placed on the ground, the whole surface or merely some of the toes? How many of the toes are to be seen? Does the form of the foot indicate that the animal is accustomed to move over hard and firm ground or soft and yielding ground, as that of a marsh? Is it easier for an animal to make speed by running upon its toes or upon the sole of its foot? What do you infer as to the ability of the buffalo to travel long distances at a fairly good speed? 7. Why cannot buffaloes climb trees, because of their size or the form and

action of their toe-nails, or both? 8. Can you think of any reasons why the buffalo has not been tamed and bred as cattle have for the flesh or for the milk and its products?

THE MOUNTAIN SHEEP.

The Mountain Sheep, or Bighorn, inhabits high mountain fastnesses from British Columbia to Arizona, but similar varieties are found outside of these limits. The average height of the animal at the shoulder is about three feet, its length about four feet, and its horns are about four feet around the curve. The form illustrated here is evidently a male, for the horns of the female are small, short, and erect. During the summer season the sheep seek the open pasture near the timber line of high mountains, feeding upon the herbage of all kinds which grows luxuriantly during the short summer. In winter they retreat to the sheltered valleys of lower altitudes, where they feed by pawing the snow from the frozen grass. In their breeding habits these animals are very similar to the domestic sheep which are described in connection with chart 44. Little needs to be said regarding the mountain sheep except that the difficulty and danger attending the hunting of it are such as to appeal to all sportsmen. The result has been their almost complete extermination, and recently their complete protection by law for a term of years has been deemed necessary to enable them to repopulate their haunts. Keen of scent, of large size, living in most inaccessible places, they are very hard to stalk. The flesh itself is highly prized and the possession of a pair of horns is very tangible proof of a hunter's skill. The color of these sheep, dingy yellow, renders them inconspicuous; the white rump-patch serves a purpose similar to that of the antelope, the wapiti, and the deer.

THE PECCARY.

Scientifically this animal is classified with the domestic pig, the wild boar of Europe, and the wart hog of Africa. Hunters hardly class it as big game, yet as an animal

highly worthy of respect. The form here illustrated is, doubtless, the collared peccary of Mexico; a very similar variety ranges northward into Texas and Arkansas, where it is called the Texas peccary. These animals feed upon acorns and nuts, upon edible roots and tubers, and sometimes upon the bark of young trees. They are at home either in the tall grass and the marsh, in the open valley, or in the undergrowth of the forest. They frequently travel in large numbers for protection, for they defend to the death with tusks and hoofs an injured member of their pack. It is said the smell of blood enrages them to such an extent that a man is hardly safe when they pursue him. Their canine teeth, very prominent in both jaws, render them formidable opponents. A musk gland secretes an odor very grateful to peccaries but highly offensive to man. However, if this be removed immediately after the animal is killed, the flesh will be untainted and highly toothsome. The general appearance of the peccary is very similar to that of a small black pig, though their mane and hair are of much thicker growth.

THE PYGMY OR DWARF ANTELOPE.

The Pygmy, or Dwarf, Antelope is an inhabitant of South Africa, where it is at home in the forests and thickets or domesticated near the grounds of settlers. It is a tiny creature hardly larger than a good-sized rat; because of its gentleness and affection, it is frequently kept as a household pet, though it could hardly be said to thrive under the influence of civilization. Though most of its kin are inhabitants of Africa, the dwarf antelope is a close relative of the chamois and the American prong-horn antelope.

THE GIRAFFE.

The Giraffe is classed with those of the Ungulata which have an even number of toes; in this case, two. Perhaps it hardly deserves special mention except as an example of how a peculiar habit may bring about changes in

structure. Now, the giraffe has no more bones in its neck than has a man, and no more in its foreleg than there are in man's arm. Yet the habit of browsing upon the foliage of trees, the constant reaching upward, has caused the lengthening of the neck and the leg until the present extreme condition has been reached. Travelers report that it is no uncommon thing for a giraffe to peer over the top of a tree, calmly scrutinizing the landscape beyond. Rudimentary horns are present on the forehead. "The long legs and neck combine to render the giraffe the tallest and, at the same time, relatively the shortest of all mammals, for its body measures only ninety inches in length, while the height at the shoulders is ten feet, and the head is from sixteen and one-half to twenty feet above the ground." The giraffe is of little use to man except as a grotesque creature for a zoological collection or as an object of the hunt; the flesh, however, is highly prized as food.

THE ZEBRA.

The Zebra is rarely suspected of being one of America's emigrants to Africa, yet such is the case, for years ago the primitive horse of America made its way, by round-about paths, to the "dark continent," where it was later isolated by submergence of the land bridges over which it had passed. The story of the horse is told in connection with chart 44. The zebra bears many similarities in form and habits to the domestic horse, but it is dissimilar in the form of the mane and tail, the size of the hoof, and the remarkable coloration. Owing to its inherent wariness, it has never been domesticated, though recent efforts on the part of the United States Army have, by cross-breeding, served to fuse certain of its valuable traits with those of the domestic horse with highly satisfactory results. The aim, in part at least, has been to produce a beast of burden of greater endurance and freedom from disease than the horse possesses. In the section on coloration an explanation is given of the utility of the zebra's stripes.

THE ELEPHANT.

The Elephant originated in Africa many ages ago, but being a great traveler wandered throughout the world, passing from continent to continent across bridges which, in many cases, have since disappeared. The primitive forms have been found almost everywhere, two of the best known being the hairy mammoth and the mastodon. Inhabiting the tropics as it does, the typical covering of hair has become reduced to the smallest possible fraction and exists merely in the form of a few scattered bristles. To prevent the evaporation of moisture from the surface, the skin has become leathery and tough, and because of this, the animal is called a pachyderm. Apparently, in its efforts to hold its own in nature, it found its size and strength very important factors; hence it became one of Nature's giants, averging a total length over all of twenty-one feet, a height of nine feet, and sometimes a weight of eight thousand pounds. So large an animal could not sustain a heavy head at the end of a long neck, hence the neck remains short. The problem of securing food was solved by the elongation of the upper lip to form the trunk, or *proboscis*. Such an animal would only find sufficient food in a locality where the sunlight, reaching the ground, would stimulate a luxuriant growth of herbage. Thus the elephant is at home in country quite open and well watered, not a desert, not a mountain top, not a region of long winters. Though not one of Nature's works of art, the elephant is one of her works of skill, and although it is said that the elephant lives to an age of four hundred years, during that time giving birth to only six offspring, yet it has maintained itself against all odds, and except for its coming destruction by man, it would doubtless continue to do so for a very long time to come. Stories of the usefulness of these animals are so common that none need be mentioned here. While the elephant is highly esteemed for its flesh, man has found its greatest usefulness as a beast of burden; he uses it in harness or under a peculiar form of saddle. The writer recalls having seen, in New York City, the members of a small

troup of elephants, on a very hot day of summer, eagerly receive into their mouths the end of a rubber hose; they held it there until their mouths and throats were full of water, then directing their trunks over their backs they sprayed themselves very effectually. The performance was complete when they scattered over their backs dirt and straw picked up from the ground.

The Asiatic elephant differs from the African form in the smaller size of its ears and tusks and its lighter color. Both are hoofed mammals, or ungulates, having five connected toes. These, however, are so shortened that the animals seem to walk on the ends of their legs which thus have the appearance of pillars. The most remarkable feature of the elephant's anatomy is the trunk; it serves both as an upper lip and as nostrils. In this way the odors of foods can be detected very delicately and material can be chosen either from the ground or from bushes and trees.

THE CAMEL.

This animal, like the horse, is one of America's gifts to the Old World; its history is similar to that already given. The only trace of it left in America is the little llama of South America. The camel has played a very important part in the slow development of civilization, carrying, as it has, conquerors in the region of Africa and Asia. The peculiar formation of the feet enables it to walk rapidly across shifting sands where any other domestic animal could not go. The development of the chambered hump, making it possible for it to store up food and moisture sufficient to last it considerable periods, has rendered it an especially valuable beast of burden in arid regions. In disposition the camel is decidedly ugly, but proper training and a thorough understanding of this trait enable one to get along fairly well with it. The Bactrian or Asiatic camel has two humps on the back, is large, robust, and has a fairly thick coat of fur, all of which enables it to live in climates colder and regions more desolate than those inhabited by the single-humped

African form, the dromedary. The flesh of young camels is pronounced delicate; the hide is used as tent coverings; the hair is woven into fabrics of strong texture.

H. B. S.

40. RODENTS.

The group of rodents as illustrated here is made up of a goodly number of mammals which, though they are as varied as the surroundings in which they live, yet exhibit certain fixed characteristics. In the first place they are all mammals, having the body covered with fur or hair, nursing the young upon milk after birth, having a four chambered heart, warm blood, and numerous other structural characteristics; most important of all is their well developed brain and relatively high intelligence. As a group the rodents are usually rather small, living in retirement in burrows, in hollow trees or in some other well protected nest; and their teeth are remarkable in that the incisors of the upper and lower jaws are especially strong and well developed while the canines are absent; thus the rodents are not fitted for eating flesh but are limited in their diet to vegetation. Almost every child has noticed these chisel-like cutting teeth in the mouth of the pet rabbit or some other rodent; if he has not noticed them the teacher could not do better than to borrow a pet rabbit for a few days, keeping it in school in some home-made cage where the habits of the animal and some of its structures can be observed.

FOX SQUIRREL.

Taking up the forms illustrated upon the chart the Fox Squirrel first engages attention. The form illustrated is the northern fox squirrel, which is similar in color to the southern form though it is smaller and has no white markings. This little creature is very familiar throughout the northern states wherever he has not been extermi-

nated by farmers and hunters. It lives in tall trees, in a hollow trunk, or in summer in an outside nest of leaves, perhaps a remodeled crow's nest. In this position it is not so aggressive nor is it so daring as many of the other squirrels. The day is not long gone when the farmer would leave his plowing to snatch his rifle and pick off one of these little fellows from the old rail fence for his dinner.

GRAY SQUIRREL.

The Gray Squirrel is perhaps the best known of all the family, for he is bold and easily adapts himself to human ways, making his nest in some spare bedroom or the attic of a house, enters cities to live in public parks, and even becoming tame enough to enter pockets of a passer-by in search of nuts and sweetmeats. The writer has even seen these little fellows run up the spokes of the wheel of a milk wagon and dart into the door to drink whatever milk may have been spilled on the floor, while the driver was absent. There are numerous instances of the introduction of this squirrel into cities with the purpose that he add to the beauty and charm of the parks and residence districts. It was soon observed that by the destruction of the eggs of the song birds and their extermination the squirrels had proved objectionable.

The squirrels have two homes, the winter nest being a cozy little apartment in the hollow tree, the entrance a knothole, and the furnishings chips and hair plucked from the parents' breast and tail. The summer home is high in the treetop, a large, loose, airy affair made of leaves and grass and various articles which may have excited the builders' interest, such as bits of lace and paper.

THE FLYING SQUIRREL.

The Flying Squirrel is a creature of the night in the northern woods; because of his disposition and his limitations in structure he is not fitted to compete with other

animals in civilization. He is seldom if ever seen, then, except in districts which are very close to the original wilderness. The skin along the sides of the body between the fore and hind legs is very full and loose; when the legs are outstretched this skin is drawn outward to form an expansion which enables the possessor to fall through the air more slowly than he otherwise would, very much after the manner of a parachute. It is the custom of the flying squirrel in leaping to sail outward and downward from some high point, arriving near the base of another tree up which it will run until the act can be repeated. When running freely on the ground the creature is at a great disadvantage and it rarely permits itself to be surprised in such a situation. These squirrels are small, gray above and almost white below.

That the flying squirrel makes a very charming pet is shown by the following extract from "American Animals":

"Professor King, in describing some that he kept in his house, says: 'I have never known wild animals that became so perfectly familiar and confiding as these young squirrels did; and they seemed to get far more enjoyment from playing upon my person than in any other place, running in and out of pockets and between my coat and vest. After the frolic was over they always esteemed it a great favor if I would allow them to crawl into my vest in front and go to sleep there, where they felt the warmth of my body; and it was very rare indeed during the first six months that they failed to ask the privilege; indeed, they came to consider themselves abused if turned out. When forced to go to sleep by themselves, the attitude taken was amusing; the nose was placed upon the table or other object it happened to be upon, and then it would walk forward over it, rolling itself up until the nose almost protruded from between the hind legs; the tail was then wrapped in a horizontal coil about the feet, and the result was an exquisite little ball of life in soft fur which it seemed almost sacrilegious to touch.'"

QUESTIONS.

1. What do squirrels eat in summer and in winter? How do they hold the food when eating? How do they carry food to their nests? 2. What do squirrels do with something they find and which they do not care to eat right away? Do you happen to know how much food they store up in the fall for winter use? Can you think of any way in which squirrels might aid nature in planting seeds? How do you suppose the squirrel finds the place where it has buried a nut? 3. Of what use do you think the squirrel's tail is? Could it be used as a rudder in jumping from tree to tree, as a balancer, as an overcoat in winter, as a means of expressing what he thinks? How is the tail held when the squirrel runs, when he sits still, and when he goes to sleep? 4. Why are the hind legs so much longer than the front ones? How many toes has the squirrel and how do they extend to enable the squirrel to cling to the tree trunk? 5. Does the squirrel gnaw a hole in the nut or first crush it? Is it easier to crack the nut before or after a hole is made in it? 6. Does the color of the squirrel make it hard to see or easy to see, and how? 7. Why are the squirrel's ears so small and the rabbit's ears so big? Does the habit of living in trees make large ears more or less necessary? 8. Is the squirrel's eyesight keen; his sense of smell? 9. How many baby squirrels are there in a nest and when are they born? How does the mother carry the little ones when she has to? 10. In what unusual places have squirrels sometimes made their nests? 11. Allow the pupils to relate their experiences with squirrels or anything they happen to know about them.

CHIPMUNK.

The Chipmunk, or ground squirrel, pictured here is the eastern variety, distinguished by the pronounced white stripe along the side; his length is usually almost ten inches. His home is on the ground within some pile of stones or under an old stump; to it he very often has more than one entrance in order that he may escape by

the back door while you are waiting for him at the front door. Life in the country would be very barren were it not for the little creatures of all sorts which, while not becoming strictly domestic, yet do not live at great variance with man and his methods. Ask any boy how he would like to live on a farm where there were no birds, no squirrels, no chipmunks or gophers, and no insects of any sort. Perhaps among the creatures that add pleasure to man's existence there is none which does more than this little creature that busily scampers about, sometimes approaching the house and often sitting on the fence post chattering at you from a safe distance. Let the farmer's big dog make a dash at this wee little creature and lo, with flit of his tail he is gone. He surely is one of our natural resources for pleasure and his conservation is well worth the trifling tax he levies upon the farmer.

GOPHER.

The Gopher of this chart is often called "Ground Squirrel," but he would be more correctly named the "Thirteen-lined or Leopard-spotted *Spermophile*." While it is often called "gopher" it should be distinguished from the pocket gopher which is not striped and has hair lined cheek pouches beside the mouth. This little rodent inhabits the United States from the region of central Indiana to Texas and western Canada, as far as the Rocky Mountains. A burrowing habit is indicated by the strong claws of the fore feet and by the tubular body. The ears are shortened while the hair is very coarse but scanty, and the tail small and slender. All the adaptations of the squirrel for the arboreal life are dispensed with here and everything which would be in the way or useless in a hole in the ground has been eliminated. The questions asked in connection with the squirrel may be used for the *spermophile* with slight change.

MUSKRAT.

The Muskrat, the largest and most valuable member of the great family of true rats, inhabits marshes, rivers,

and lakes throughout the northern United States and Canada. Even has it come to dwell in isolated ponds in prairie country, doubtless migrating during the wet season. It is protected with a coat of fur which is valuable to the rat and at the same time valuable to man; especially is this true of those varieties living in the North. The pelt is sold under various names, perhaps the most pretentious one being Hudson Seal. A good fresh pelt brings the boy who secured it anywhere from thirty cents to a dollar, varying upon the condition and color as well as upon the honesty of the furrier who fixes the price.

The length of a fair sized animal is about two feet, over all. The feet are comparatively small for so large a swimming creature but the flattened tail, which is held in the same position as that of the fish and used in the same way, makes up whatever of motive power is lost through the smallness of the feet. It makes its home sometimes in burrows in the banks and sometimes far out in the pond or marsh, using for the purpose strong reeds or small sticks and mud. In every case the mouth of the burrow is below water and is entered by diving; thus it is protected very well from the weasel, ferret, and mink. The food material is sweet flag, lily bulbs and roots, and fresh-water clams, and even fish. In discussing the muskrat with the class it is very probable that specimen pelts can be obtained and used for demonstration.

BEAVER.

Very similar to the muskrat in habits is the beaver, a real American and a member of one of our first families. Its weight may be as much as fifty pounds and its length between two and three feet. Owing to its habit of working by night it is rarely seen in the wilderness unless one should make it his business to watch a beaver pond at dusk. In order to make a pond in which to build homes similar to, but more elaborate than those of the muskrat, beavers girdle trees, fell them by gnawing them off near the ground, cut the branches into suitable lengths, form

of them the framework of a dam across some stream and fill in the interstices with mud which is carefully and solidly plastered into place with primitive trowels, it was formerly thought with the beavers' own tails. Not only does this pond serve as a moat outside the castle wall, but as a cool cellar wherein the food is stored. The food of the beaver is tender vegetation, particularly the growing bark of trees and the succulent twigs which are obtained in felling trees.

The beaver house is made of poles arranged in the form of a tent so that while its base rests upon the bottom of the pond the chamber within will be above the level of high water; many observers claim that the condition of a stream for the ensuing season is foretold by the beavers, for before seasons of very high water the home is built unusually high. The instinct of home building is so deep seated in the beaver's mind that in some cases young animals which have been reared in captivity have attempted to build a beaver house out of various articles at hand, such as umbrellas and canes. It is doubtless the case that the instinct as such exists in the beaver, but that many of the details of house building are learned by observation during the first few seasons of a young beaver's life.

QUESTIONS.

1. Where does the beaver make its home? Why do you suppose the house is made out in the water instead of on land? 2. What enemies has the beaver? Whereabouts do you suppose the door to the house would be located? How do you suppose the living room of the house would be furnished? 3. Do beavers sleep during the winter or are they active? How would a beaver get air if it should swim out from its nest and find the pond covered with ice? 4. What do beavers feed upon? How do they get food in winter? 5. What use does the beaver make of his tail? Is it a rudder, a propeller or trowel? 6. Compare the beaver's feet and legs with those of the muskrat, pointing out any differences you

notice and explaining them as well as you can. 7. If a beaver pond should be drained and the bottom exposed would it be valuable land for farming? Why are the places where beaver ponds used to be all clear and without trees, or openings in the woods? 8. Why have beavers been so nearly exterminated in North America? How are they caught? What is the value of a beaver skin? At what season of the year would it be in best condition? For what purposes is it used? 9. How could you distinguish a tree which had been cut down with an axe and one felled by a beaver? What kind of teeth and jaws do you suppose a beaver has? How would a beaver keep his teeth sharp?

WOODCHUCK.

The Ground-hog or Woodchuck is one of the few animals which have thrived under the influence of civilization, though it would hardly be correct to say he has become civilized. By the elimination of the woodchuck's natural enemies, such as the fox and weasel, man has in a way granted him protection and he is sufficiently prolific to bring about a rapid increase in numbers in any locality. Wherever this picture is used the children will be familiar with either the woodchuck or his near cousin, the prairie dog, and what is said of one will apply very well to the other.

The ground-hog has a very coarse fur which is seldom used, though the skin, when properly tanned, makes good shoe strings, and may serve other purposes. As indicated by the shape of the body, the size and length of the legs, and the strong toe-nails, this fellow is essentially a digger. He can keep pace at this business with the ordinary farmer boy who tries to dig him out. The woodchuck frequently makes his home on a hillside, though he is not unwilling to live under a barn. His burrow usually has more than one entrance, seldom more than three. The burrow is so made that the living room is not far below the surface and not the lowest point of the tunnel, so that rain does not drain into it; it is well-nigh impossible to

drown out a woodchuck family. The male and female usually live in separate burrows, though at the time the litter is born they may be living together; the young leave the parent burrow in midsummer to make homes of their own.

The woodchuck is strictly herbivorous and semi-nocturnal. It leaves the burrow in the late afternoon and returns to it not later than very early morning, though as fall approaches it spends more time foraging. It eats apples, sometimes climbing the tree to obtain them, and is very fond of melons and almost anything else which is succulent.

In feeding the animal usually sits upright on its hind feet and holds the food to the mouth with the front feet. A full grown animal is usually nearly two feet long and ranges in color from brown to silver gray. The ears are small and by muscles can be closed while the animal is digging. Woodchucks do some damage to farm crops, particularly garden stuff, and the burrows in the open field might mean the ruin of a horse through the breaking of its leg. The presence of a woodchuck on a farm adds considerable interest to a life which otherwise might be monotonous, and a quick interest in such relatively harmless animals is a thing to be stimulated.

QUESTIONS.

1. Where did you ever see a woodchuck's home? Describe it as fully as you can. Where did you see the woodchuck and what was he doing? 2. How fast can the woodchuck run and how does he run, by jumping, running freely, or waddling? 3. What good is the woodchuck's tail? What good is the fur and skin? Is the woodchuck slender and graceful or pudgy and cumbersome? 4. Why are the hind legs so much longer than the front ones? 5. Why does the woodchuck eat so much in the fall? What does he do in the winter time? 6. What is the story about the ground-hog and Candlemas day, February second? 7. How many baby woodchucks are in a family? When are they born and

how are they cared for? 8. Have pupils write a short account of some personal experience with a woodchuck.

The teacher is urged to investigate the prairie dog question as it affects the plains region and to learn what steps, if any, are being taken, either nationally or locally, to wipe out the nuisance.

POCKET RAT.

The pocket or kangaroo rat pictured is one of several species, all inhabiting that portion of the United States from Iowa westward and southward, even into the desert regions of Arizona. It is a tiny creature with an excessively long tail which bears at the end a very elegant little tassel of hair. The hair of the entire body, in fact, is long and silky, and the pockets in each cheek are hair-lined. These pockets are used, like those of many other rodents, for storage of food while on foraging expeditions, or as receptacles for dirt when the animal is digging. This rat is said not to bite while being handled but to make a very difficult pet inasmuch as it does not thrive in captivity. Probably a good way to handle these as well as nearly all other wild creatures is to leave them alone to enjoy their lives in their own way or else if they are injurious to exterminate them as quickly and as painlessly as possible. It is reported that the kangaroo rat is increasing in numbers rapidly in certain districts in the West, now that many of its natural enemies have been exterminated; that it is pilfering granaries and warehouses.

GRAY RABBIT.

The Gray Rabbit, or cotton tail, one of the largest members of the rodent family, ranges from New England to Minnesota and southward to Central America, varying slightly from place to place. It is the common pet of children as well as the source of winter income for many a boy who possesses a gun. Like all other true rabbits it is distinguished from the hares by its smaller size, relatively short ears, and short legs. It is not a good

runner when caught in the open but what it lacks in speed it makes up in cunning; when closely pursued it may double back upon its trail or dodge in and out of brush heaps and fences.

Its home is usually a burrow in the ground or a deep recess under the roots of an upturned tree. When the young are born they are naked and blind but the mother plucks hair from her own breast to protect the little fellows and keep them warm. Upon leaving the nest she always covers them with this material and instinct teaches them to lie still and make no noise which would betray their presence to any passing foe. As a call or warning rabbits frequently beat a tattoo upon the ground with their hind feet; when running the flashing of the white hair on the under side of the stubby tail wigwags a signal to play-mates or companions.

Like other rodents rabbits feed upon vegetation, in the summer eating carrots, parsnips and other green material, while in winter, should a crust form upon the snow and prevent their reaching herbage underneath, they strip the green bark from trees and bushes, thus frequently doing great damage to fruit orchards. To prevent this many orchardists use tree protectors of woven wire. The flesh of rabbits is highly esteemed and the pelt is treated in various ways to make it valuable in the manufacture of furs. The fur is so light in weight and the skin is so thin that the pelt is not valuable except for felt hats.

QUESTIONS.

1. Where and when have you seen rabbits, either tame or wild?
2. How do boys and girls provide homes for rabbits? What pet name is usually given to a rabbit? What is the place called where rabbits are raised? Do they dig burrows or make their nests on top of the ground?
3. What color is the rabbit in summer and in winter? Why does the color change?
4. When rabbits run do they try to get under something or do they strike for open ground? How do they run, by jumping or trotting like a horse?
5. Why are the hind legs so much longer than

the front ones? If the rabbit in the picture should stretch out his hind legs and stand on his toes what would be his position? Does a rabbit ever do this? 6. Do rabbits feed while sitting down or do they stand up? What do rabbits eat? Describe the peculiar motion of a rabbit's lips and teeth while eating. 7. Whereabouts on the head are the ears placed? How would this position affect their hearing? How do the ears act in order to catch sounds from different directions? 8. Judging from the position of the eyes do you think the rabbit sees things on either side of him, does he turn around and look forward, or does he turn his head from side to side? 9. What name is given to the family of young rabbits? How many baby rabbits are there in a family? How old are they when they begin to eat vegetables? How old when they leave the nest? 10. How many families may a pair of rabbits raise in a season? Why are rabbits so hard to exterminate? 11. The teacher should tell the older classes about the events attending upon and following the introduction of rabbits and hares into Australia.

PORCUPINE.

The Porcupine, though a member of the usually timid and defenseless rodent family, has developed an astonishing amount of what is usually called "cheek." It is a matter of speculation as to what would happen should a skunk and a porcupine meet on the same trail in the woods. The Canadian porcupine and its cousin, the yellow-haired porcupine of the far West, are quite similar to a European form called the hedgehog, though the habits of the American animals are so different from those of the other that the two names should not be confused. Our forms feed upon the bark of trees and perhaps animal matter which they may discover still undecayed. The Canadian species is a good climber and frequently rests by day in the tops of trees but the nest is made and the young are reared in some burrow or cavity in the ground.

The flesh is said to be too tough for eating and the skin is useless except as a curiosity. Along the back

certain of the hairs have become very highly developed in size and stiffness, forming what are popularly called the "quills." The muscles of the skin cause these to be erected for defense or to lie flat when not needed. The development of this means of defense has rendered great intelligence unnecessary and the animal has become slow of movement and dull of wit. As a last extremity in defense the creature rolls itself into a ball because the belly has upon it no quills and is defenseless; it is the weak spot in the armor.

A very good description of the habits of the porcupine is given in Burroughs' "Squirrels and Other Fur-Bearers"; portions of it are quoted here:

"When you come suddenly upon the porcupine in his native haunts, he draws his head back and down, puts up his shield, trails his broad tail, and waddles slowly away. His shield is the sheaf of larger quills upon his back, which he opens and spreads out in a circular form so that the whole body is quite hidden beneath it. The porcupine's great chisel-like teeth, which are quite as formidable as those of the woodchuck, he does not appear to use at all in his defense, but relies entirely upon his quills, and when those fail him he is done for. The quill of a porcupine is like a bad habit; if it once gets hold it constantly works deeper and deeper, though the quill has no power of motion in itself; it is the live, active flesh of its victim that draws it in by means of the barbed point."

H. B. S.

41. CARNIVOROUS ANIMALS.

The carnivorous animals are so called because their diet consists almost exclusively of flesh. It is not often the case that the animal preyed upon stands quietly about awaiting capture; the captor is compelled to exercise every means at his disposal to get his dinner. The carnivora are, as a rule, then, of active, alert and even

ferocious disposition, endowed with great strength or great craft and fitted in various other ways to pursue the prey wherever it may go. Thus they are able to climb trees, to capture the tree dwelling rodent, the squirrel; to enter burrows in pursuit of the rabbit or the chipmunk; to swim to the nest of a beaver; to catch fish; or to hunt across the open plain, running down the deer. As a group they are characterized by having the canine teeth especially well developed and the grinding teeth reduced from broad heavy structures to more or less pointed and tearing ones. The mouth of a rodent is quite frequently under the face to a certain extent while that of a carnivora is at the extremity. As a general thing the flesh of carnivorous animals is not eaten by man; their fur frequently is very valuable.

OTTER.

The Otter formerly inhabited almost all of North America north of Mexico but the great value of its pelt has been the cause of its almost complete extermination. As the form of the body and tail indicate, the animal generally lives in a burrow and spends much of its time in water, feeding upon clams and fish. Its average length is about three feet. In swimming it is sufficiently expert to capture such fish as the pickerel and the trout. Though its short legs put it at a disadvantage on land, yet it frequently forages in woods and thickets, its great strength enabling it to kill even a deer which it might come upon unawares. There are usually two young in a litter and they are carefully protected for perhaps a year after their birth. The otter is said to make a good pet; it is noted for its playful habit of sliding down muddy banks into the water or of romping on the turf near some stream.

SKUNK.

The Skunk also goes by the name of polecat and bashful young ladies sometimes call him a kitty. The skunk enjoys his freedom throughout the United States and

Mexico, living in holes under stumps or in hollow logs and foraging through the woods and in poultry houses. He is very conscious of his superiority and remarkable for his self composure even under very trying circumstances. The white marks upon his black fur are very conspicuous, rendering him easily seen; his scent is so obnoxious to all animals that he is well-nigh immune from attack. The secretion for which this animal is famous is formed by certain glands at the base of the tail and is ejected in two fine streams which can be thrown for a considerable distance; it is used only in emergency, for when unmolested the skunk is of cleanly habits. He is an excellent digger and a poor climber; his average length is two feet. His pelt is highly valuable and the oil tried from the fat in winter is very efficacious for treatment of colds.

POLAR BEAR.

The Polar Bear is an inhabitant of the far north where it lives in the vicinity of the open sea, subsisting upon clams and various fish as well as upon such plant material as edible bulbs and tubers. The heavy coat of thick fur gives to this bear an appearance of great size, though in reality it is not so very much heavier than the black bear pictured on the opposite side of the Chart. The average weight of the polar bear is about seven hundred pounds; its flesh and fur are used by native Eskimos.

QUESTIONS.

1. Where does this bear live? How does he get his name?
2. Do you suppose he can swim? How do you think he keeps from slipping on the ice?
3. Do you suppose he could climb a tree? Do there seem to be in the picture many trees to climb?
4. How does this bear keep warm in winter? "The female with her young hibernate in snow but the male is active all winter."
5. Do you think this bear eats a great deal or only a little? What sort of food do you think he could find

to eat? What are baby bears called? How many are there in a family? 7. What use does man make of the bear's skin? Why do you think the fur is white? 8. What does the bear in the picture seem to be thinking? Do you know anything about the disposition of this kind of bear?

BLACK BEAR.

The Black Bear formerly ranged throughout the woods of almost all of North America and it still exists in lonely isolated districts. Its original color is black but when it shades into brown the creature is called the cinnamon bear. It is distinct from the grizzly and polar bears in its smaller size, its black color uniform over the body, its low hind quarters and humped back. Its average weight is 500 pounds. It is good tempered but timid and is perhaps the form most commonly met in parks and traveling shows. In the wild state it feeds upon berries and succulent herbage; also upon pigs, calves and smaller domestic animals. This picture illustrates very well the peculiar way in which the hind feet are used, the whole of the foot being placed flat upon the ground. Thus the weight is distributed over a broad surface and the animal is enabled to tread upon such soft yielding material as marshy ground or snow. The black bear is a good climber and many stories are told of its strong liking for the honey to be obtained in hollow trees.

QUESTIONS.

1. What is the matter with the bear's tail? 2. Are the ears large or small; the face long or short; the eyes small or large? 3. Do you think this animal would be a good runner on the open plain or would it be more at home in woods and rocky country? 4. Does the color of the animal seem to indicate a life in a shady or a sunny place? 5. What stories have you read or heard describing the habits of the bear or the tricks of trained bears?

WALRUS.

The Walrus is distinguished from the seal, another member of its family, by its greater size, by the great development of its canine teeth in the upper jaw to form tusks, and by forward position of the hind feet. It inhabits the polar oceans, feeding upon whatever animal material it can catch in the open sea or dig up in shallow water. The Atlantic walrus pictured here sometimes attains a weight of almost a ton, its skin alone weighing over two hundred pounds and its length being over ten feet. It has been hunted for the ivory of its tusks and for the oil obtained from the thick layers of fat which are found close under the skin, wrapping the body like a blanket. Such fat is common on all mammals living in extremely cold climates, for it is essential to the conservation of their body heat and the preservation of their lives. The walrus furnishes the staple food of the Eskimo, and the indiscriminate destruction of these animals, along with that of other polar creatures, means the starvation of whatever Eskimos may have survived the intoxicants and the diseases introduced among them by white men as essential parts of civilization.

RACCOON

The Raccoon is one of the commonest carnivora in the United States, because of its docility proving a very satisfactory pet. The average size of the raccoon is slightly less than three feet. It feeds upon almost everything; while in summer it is particularly fond of green corn and garden crops, it does not disdain grubs, the eggs of birds and even birds themselves if they can be caught napping. By day the raccoon usually sleeps high up in some hollow tree or in the crotch of a limb; by night it prowls about hunting for food or gamboling in some marshy place. The raccoon is too well known to need an extended description. Almost every pupil would be glad to tell his experience with a raccoon or to give some story about it which he may have heard or read. The raccoon family usually consists of two parents with

from three to six babies which are very carefully tended for a considerable time. The young are said to resemble kittens in their condition at birth. In the structure of the teeth and feet the raccoon is very similar to the bear, hence its diet and its methods of locomotion are similar. In disposition it is sly, cunning and curious. It is said to go out of its way to run the length of a fallen tree and to spend hours playing with some shining object which may attract its attention. Raccoon traps are often set having as a lure a piece of tin or a bright shell hung so that it will swing in the wind or placed on a trap-tongue in water near the shore.

QUESTIONS.

1. In the picture where does the raccoon seem to be going? Why would it go there? 2. Describe the shape of the raccoon's face and its expression? 3. What color markings do you see on the head, the body, or the tail? How would you distinguish a raccoon from a skunk; by color or by the tail? 4. What is the shape of the raccoon's feet? Has it toe nails or claws? What sort of a track would the raccoon leave? 5. Is it able to climb trees? Would you be most likely to find a raccoon in the open field, a grove, or the dense woods; in burrows or in tree tops? 6. Tell anything you know about the habits of raccoons.

MINK.

The Mink is to be found throughout almost the entire United States, though it varies slightly from place to place. It is almost always of a dark reddish brown color with some white upon the chin and breast. It is at home any place, in water, in a crevice between rocks, and in the tree tops, feeding upon fish, mice, birds and their eggs, or in fact, upon almost any animal material. In running, its long body doubles up so that the hind feet overreach the front ones, and thus the animal is able to give a prodigious bound; its great agility is remarkable. The form of the mink's body enables it to enter the bur-

rows of various rodents and its color permits it to hunt in comparatively open country. It does not hesitate to forage in farmers' hen houses where it seizes the chicken by the throat and drinks the blood, often killing several fowls during one night. The fur of the mink is so highly prized that the animal has been almost exterminated

FERRET.

The Ferret is "first cousin" to the mink and very similar to it in habits. It has long been domesticated and used by hunters in catching or driving out from their burrows rats, hares, rabbits and prairie dogs. The form here illustrated is the black-footed ferret of the Rocky Mountains from Kansas to Montana. Because of its habits it has obtained the nickname of "prairie dog hunter." This picture and that of the mink show very well the tooth development of a strictly carnivorous animal; the tusks of the walrus are merely overdeveloped canine teeth. The otter, the skunk, the raccoon, the mink and the ferret are scientifically placed in one group because of their common structures; they are also characterized by the development of certain scent-glands which give to all the members of the family a marked and peculiar odor. The raccoon and the bear form another family, the walrus a third; the hyena is a closer relative of the wolf and the dog.

HYENA.

The striped Hyena here illustrated is one of the three species inhabiting the Old World; this form is not found in Africa alone but it occurs also throughout southern Asia. It is the one most often seen in traveling shows for it may be trained to perform to a rather limited extent. When seen from the front the creature presents a large head and ears, a large mouth and an ugly countenance, but when viewed from behind it seems to be slinking, the hind quarters being carried low and the tail hanging down. It is probably one of the meanest, most cowardly and most detested of creatures. It feeds upon whatever

animals it can catch and upon the refuse of towns, even attacking the bodies of the dead. Among certain savage tribes of Africa any sick man who has not responded to customary treatment is taken outside of the village and left under a tree in a helpless condition; the hyena does the rest.

H. B. S.

42. ANIMALS OF CAT AND DOG KIND.

There are here illustrated two general types of carnivorous animals: the cats, characterized by the relatively short head, small ears, and retractile claws; and the dogs, which have long pointed faces, more prominent ears, bushy tails, and non-retractile claws. The teeth of the dogs are not so strictly carnivorous as those of the cats, hence their diet is not limited entirely to flesh and their disposition is not so ferocious but is more kindly; the animals thus are more adaptable to domestication and to training as friends or pets.

TIGER.

The Tiger, the royal beast of India, is the largest cat in existence. Stories of the habits of tigers are too common for repetition here, and the fact that the animal is never met with by an American at home makes it inadvisable to discuss it fully. The native of India believes that after the death of his relatives and friends their souls become incarnated in the bodies of other animals, particularly those of the tiger. For this reason, he is unwilling to slay the beast and even protects it, though he may live in terror of his life. In certain districts the existence of these animals is a great hindrance to the development of the country.

LION.

The Lion, another large cat, is a native of Africa, where it lives in partially wooded country. It is important in man's welfare inasmuch as it frequently destroys

the stock of settlers in the frontier regions; sometimes the settlers themselves are slain. The hide is sometimes used as a rug, its price for this purpose being about \$600. It affords an excellent outlet for the primitive hunting instinct which survives in civilized man.

OCELOT.

The Ocelot is the size of a small dog. It ranges from Louisiana and Texas southward through South America, living in tree-tops or in rough country, and preying upon deer and similar forms. It will be noted that the spots and stripes on its body extend lengthwise or horizontally.

PUMA.

The Puma, also called mountain lion, cougar, panther, and painter, lives in mountainous districts throughout the west and in the east from the Adirondacks to Florida; its range even extends southward throughout South America. Its home is usually a hole in the rocks or a sheltering treetop. It preys upon rabbits, deer, sheep, and other domestic animals, which it captures by still-hunting, either stealing upon them unawares or dropping upon them from some crag or treetop. Of all the cats it is the best climber, the best hunter, and the biggest coward when facing man.

WILD-CAT.

The Wild-cat illustrated is the lynx, commonly called bay lynx, bob cat, and catamount. It formerly ranged throughout the United States in woodlands or districts at least partly timbered, and still exists in remote spots where it feeds upon birds and their eggs, sheep, and even upon wild mice. It is notable because of its short tail. Its fur is highly prized, a pelt bringing about ten dollars. The picture hardly does the animal justice, for it is one of the most beautiful of all the cats. The short tail and tufted ears proclaim it a lynx. Its disposition is wild and untamable and though young wild-cats have

sometimes been adopted into human families, yet they very soon revert to the wild state.

Fox.

The Red Fox is a true American, ranging throughout the continent. Its value as a fur animal is not great, though the pelt is frequently used. The farmer lad most frequently hunts it, either because of his eagerness to kill or because the fox may have made serious inroads upon the poultry house. The gray fox is more southerly in range than the red, slighter in size, but a better climber, for it is able to ascend low trees. The fox is noted for its slyness and cunning and to these traits it owes its life. When hard pressed by a dog, it will wade in a stream or run upon a public road in order that its scent may be lost. Some stories have it that it will even jump upon some high object, wait there until the dogs have passed, and then retrace its steps, to the dogs' utter confusion. In the wild state it probably preys mostly upon eggs, birds, chipmunks, rabbits and mice. Whenever it raids the farmer's poultry yard the turkeys, which always roost high, are safe, but the chickens and ducks fall an easy prey to the fox. The young foxes are born in early spring in some small cavern under a rock or fallen tree; there are usually three or four of them in a litter.

THE BLACK WOLF.

The Black Wolf here illustrated is a variety of the gray occurring in the Florida Everglades, a district which until recently has been so inaccessible that various animal forms have been able to persist there long after their extermination elsewhere; a description of the gray wolf will apply almost equally well to the black. These fellows usually attain a height of nearly three feet. They formerly ranged throughout North America but have been eliminated from all districts except those very remote or sparsely settled. They are always hungry, always restless, and always skulking, except where their numbers are such as to give them courage.

In hunting, particularly during the winter, they travel in packs of from five to twenty, or even more. Their custom is to run down their quarry in open chase, a fox, a deer, or even a buffalo or bear. They frequently attack herds of cattle on the plains. The cattle, for protection, gather into a compact mass, keeping the calves at the center and standing or moving with their heads outward. The wolves circle around the herd in a constantly narrowing line, drawing inward and attempting to entice a member of the herd to rush outward. If such an attempt is successful, the pack immediately cuts off its retreat and its life is lost. Occasionally a wolf will succeed in leaping upon the back of some member of the herd, and jumping from one to another, it will create confusion and the demoralization of the mass.

The gray, or timber wolf, and its smaller cousin, the prairie wolf, or coyote, are similar in habit, though the latter is slighter and smaller. Of the coyotes there are believed to be several distinct varieties. The skins of wolves are not particularly valuable as fur, though they are often used for cheaper grades of rugs, fur coats, lap robes, and gloves; the hair is too coarse to afford warmth. The price of the wolf skin is usually considerably less than a dollar. Wolves are very hard animals to trap but they are frequently killed by means of poisoned meat.

QUESTIONS.

1. Does the wolf look to you more like a dog or a cat? Which of the wolf's features particularly resemble those of the dog or cat, the shape of the face, the size and position of the ears, the kinds of teeth, the tail, or the feet?
2. Are the toe nails of the wolf and the dog drawn back and protected when not in use, or pushed outward? Are they sharp or dull? Can the wolf climb a tree like a cat? Why?
3. Are the feet as well cushioned and noiseless as those of the cat? Describe the cushions of a cat's foot.
4. How many toes has the wolf or the dog on each foot? How many has the cat?
5. How does the wolf run when in a hurry? How is the tail carried?
6. Do you suppose

its sense of hearing is keen? Its sense of sight? Its sense of smell? Its sense of taste? Why is it so much easier to kill wolves with poisoned meat than it is to catch them in a trap? 7. What kind of calls or cries do wolves utter? What means have they of conveying news of any sort to each other? 8. Since the wolf is so similar to the dog in habits and disposition, can you guess how many young wolves there would be in a family and what their dispositions would be like during their puppyhood? 9. Have you had any experience with wolves or have you read that of anyone else? If so, tell it to the class.

H. B. S.

43. STRANGE MAMMALS.

CLASSIFICATION OF MAMMALS.

In studying animals with classes of upper grades in the high school the question of classification should be taken up at least sufficiently well that the pupil will realize that an orderly arrangement of things zoological is not only important but necessary. Many teachers have found that this question is received with the best results if it is presented only after the pupils have had considerable chance to observe or study many various forms. It is with this in mind that we take up here, in connection with one of the latter charts, the classification of the group of mammals. The most primitive order is that of the duckbill, *Monotremata*. The next order is that of the opossum and kangaroo, *Marsupialia*. The following order is that represented here by the armadillo, *Edentata*. Following this let us place the order of whales, *Cete*; then the hoofed animals, *Ungulata*; the rodents, *Glires*; the bats, *Chiroptera*; the seals and walruses, *Pinnipedia*; the flesheaters, *Feræ* or *Carnivora*; and lastly, the monkeys, apes, and man, *Primates*. This classification is not complete; it deals simply with those forms illustrated on the various charts of the Study.

BAT.

On chart 43 the first forms illustrated are the bats, red and brown. The red bat is the commonest one in the United States. It is a little creature hiding in the dense foliage of some large tree or under the eaves of a barn during the day and flitting erratically to and fro at night in search of the large night flying moths and such other small game as may be on the wing. The brown bat is more southerly in its home than the red bat, seldom occurring north of the Ohio valley. It is somewhat larger than the red bat but its habits are the same. In the early evening it is a common trick for a boy to throw up his hat; into it the bat will dart, probably mistaking it for something to be attacked. As both come tumbling down the boy may seize the bat only to get a sharp bite on the finger or to find that the vermin with which this hairy creature is infested has left the bat and is crawling on his person. Because the bat's hands have been changed into "wings" it is not able to keep itself clean and it has become one of the dirtiest of creatures. These animals are active only during the early part of the night. The young are nursed with the mother's milk and at first are carried by her on her foraging expeditions.

The bat and the mole are so similar in internal structure that it would seem as though in some past time the ancestors of these animals had found that they could not successfully compete with birds in their search for insect food, and had decided to become nocturnal and aerial or to enter upon a burrowing life in the ground. To fit these creatures for such an existence the moles have become essentially diggers while the bats have become fliers. The bat's thumb is still free, forming with its thumb nail a tiny hook on the front edge of the wing, while the other four fingers have become elongated and connected with a delicate membrane of skin. This membrane is covered with fine down, though it is somewhat hairy near the body. The hind feet have not been greatly changed and the five toes are of equal length and set close together. When at rest by day, the bat usually

hangs head downward, though it can assume an erect position almost as conveniently.

MOLE.

The Mole is familiar to every child throughout the country, for it is frequently upturned by the plow or caught in a mole-trap, though sometimes it is seen on the open ground during the day. The fur is very thick and soft and sometimes is used for the lining of garments. The nose is long and the shape of the head is well adapted to forcing a way through the soil. The eyes are present in the skull but are unable to see. The fore feet are remarkably developed for digging, heavy, strong toe nails being borne on correspondingly large strong feet. The mole is popularly thought to feed upon potatoes and garden crops and to be the enemy of man but investigation has shown that it is not able to live upon a vegetable diet; no vegetable remains have been found in a mole's stomach and in captivity it subsists almost entirely upon such animal food as cut worms, grubs, and other insect larvæ.

HYRAX.

The Hyrax, or Cony, is a small animal inhabiting rocky districts of Africa and western Asia. It is a lively little creature about the size of the American rabbit; it is a cliff dweller. Scientifically speaking the cony belongs in the group of hoofed animals very close to the rhinoceros. It is spoken of in the Bible and we know from the stories told by the rocks that in very ancient times its ancestors were animals of greater size and greater numbers than those existing today. The modern cony is much sought after for the fine thick fur; this is dyed and manufactured into muffs and other fur garments.

DOLPHIN.

The bottle-nosed Dolphin illustrates how an animal may change in external form and structure to suit itself to peculiar surroundings, for the dolphin is a true mam-

mal in every sense of the word. The fore legs have become developed into flippers while the hind legs are embedded in the flesh of the body. One fin has arisen on the back while a horizontal tail appears at the hinder end. The dolphin is often called "porpoise" along the sea-coast, but this is a misnomer inasmuch as porpoises have a uniformly round head. It is common along our Atlantic and Gulf coasts from Texas to Maine and it also occurs on the coast of Europe. Dolphins gather in great herds or schools and seem to engage in various contests of skill or games, leaping from the water in graceful curves or swimming just below the surface so that the arching back with its fin can be seen from a distance. It feeds upon fish and other animal material, for teeth are present in both jaws; it breathes air directly at the surface of the water. The bottle-nosed dolphin averages in length about nine feet. The tanned skin is used for shoe strings and soft leather.

WHALE.

The Greenland, Polar, or Bowhead Whale is the most important member of the group *Cete*, not only because of size, for its average length is about fifty feet, but because of its commercial products. A single animal usually yields about twenty thousand quarts of oil and almost a ton of baleen, or whale bone; its total value sometimes amounts to ten thousand dollars. The flesh is seldom eaten except by the natives of the far north. This whale ranges throughout the Arctic Ocean and the higher latitudes of the Atlantic and Pacific oceans. It frequently gathers into schools, sometimes of large numbers.

The food of the whale consists of jelly fishes and other marine forms which exist in great quantities near the surface of the sea. These are taken into the mouth in one large gulp, the jaws shut, and the water is then forced out between plates of whale bone. The number of these plates varies from 300 to 360 and their length may be as much as sixteen feet; they hang like blades

from the jaws and form a strainer. When breathing the whale rises to the surface and from its nostrils and throat blows water and vapor in the form of a column, or "spout," to the height of fifteen or twenty feet. The mother usually gives birth to one offspring during March or April and nurses it for several weeks. The baby grows very rapidly and the mother is extremely solicitous of its welfare, fighting to protect it even at the sacrifice of her own life.

The enemies of the whale are several species of the shark and a form of dolphin known as the killer whale, or orca. Perhaps the greatest enemy of the Greenland whale is man, who hunts it in a modern vessel with high-power engines and explosive bombs. Surrounding the body of the whale is a layer of fat, or blubber, often eight inches in thickness, which is cut from the body in chunks and tried out in caldrons on the deck of the vessel. The plates of baleen from the jaws are now used by being scraped very fine and mixed with the silk fiber of dress silks to make the cloth rustle when worn and to give it stiffness.

PLATYPUS.

The Duck-billed Platypus, Duck Mole, or Duck-bill, occurs only in Australia. It is the most primitive of all mammals, for the young appear from eggs which are deposited in a small nest and after hatching are nourished on the mother's milk; at first they are blind and helpless. In size the platypus closely resembles the prairie dog; in habits it resembles the muskrat, feeding upon small insects, cray fish and worms which it may find in the water; its horny jaws are shaped like the bill of a duck and its feet are webbed; thus it seems to be partly mammal and partly bird.

ARMADILLO.

The Armadillo here illustrated is the nine banded form which ranges from southern Texas and Arizona to southern South America. It belongs to the group of mammals

called *Edentata* (meaning "toothless"), for it has no front teeth. The armadillo is so well protected by its coat of mail that in spite of its timid disposition it feels safe to forage by day as well as by night. Using its strong digging claws and long sticky tongue, it feeds upon insects, worms and lizards, creatures which it can catch unawares or which it can dig from burrows. The illustration shows very well the claws, also the lack of armor on the under part of the body. We easily understand now, why the animal, when in danger, rolls itself into a ball and presents no weak spot to the enemy.

These animals are very common wherever they exist; they are sometimes used for food because their flesh is very sweet in flavor, and they are often kept in or near houses because they prey upon small house rodents and vermin. The armadillo is a modern representative of a very ancient family which at one time was very numerous and the members of which attained considerable size.

KANGAROO.

The Kangaroo and the Opossum belong to a group of mammals called *Marsupialia* because they possess on the stomach a pouch within which the young are kept and nursed for a considerable time after their birth. The young of the opossum, the kangaroo, and the mouse are said to be at birth of almost the same length, about three-fourths of an inch.

The kangaroo is a native of Australia, the form here illustrated being the gray kangaroo, "Old Man" or "Boomer." It stands about four feet high and weighs almost two hundred pounds. The peculiar development of the legs is probably due to the habits of the animal, for it lives in regions where the grass grows tall and where the animal can get along only by rising out of the grass and jumping. In this action the tail probably acts not only as a rudder and balancer but also as a spring at the beginning of the jump. It is said that the kangaroo can jump twenty feet at a single bound. The fore legs

merely catch the animal upon alighting and hold the food while it is being eaten.

It is a comparatively timid and defenceless creature, relying upon its color to escape notice and upon its marvelous speed to get away from its pursuer. It delivers a powerful blow with the hind foot. The structure of this foot is peculiar inasmuch as the middle toe only is well developed, the side ones being aborted. The kangaroo has been almost exterminated in Australia because its hide is valuable for tanning. It feeds upon herbage, fruits and the young twigs of bushes and low trees. It is intelligent and capable of domestication; when trained it easily learns to box with or without padded gloves.

OPOSSUM.

The form here illustrated, the Crab-eating Opossum, is essentially a tropical South American form; it illustrates very well, however, the common Virginia opossum of central and southern United States. This creature lives in trees, feeding not only upon fruits and certain edible portions of the tree but also upon insects, lizards, birds and their eggs. In size it is usually about two feet in length. The grayish hair is long and coarse and useless to man. The flesh has a characteristic flavor and, while eaten to some extent by the white people of the South, is regarded by the negroes as their exclusive delicacy. The animal is rather dull of wit and sluggish in habit, its only means of protection being by escape into the treetop or by lying quiet to simulate death.

In the season of cold the opossum makes a nest of leaves and grass in some sheltered spot in the tree or in a hollow log, but in the summer a nest is rarely used. The young opossums are usually about ten in number and the litters appear so frequently that sometimes a mother is found with her first family upon her back and her second or more recent family in the pouch upon her stomach. The older babies are carried about upon the mother's back, their tails clinging to hers, or perhaps they hang to her neck and legs.

QUESTIONS.

1. What experience have you had with an opossum? How large was the creature? Where and when did you see it? 2. What is the opossum's color above and below and what marking has it upon the body? 3. What is the shape of the opossum's head and face, and what is its expression? 4. Does the opossum live in a cold region? Is the hair needed to keep the animal warm? Is it of any use to man as fur? 5. How far down on its tail and legs does hair extend? Can you think of any reason why the tail and feet should be so bare; would the hair be in the way and get soiled; do not its feet get cold? 6. How many fingers and toes has the opossum and how long are they? Where are the thumb and the big toe placed on the hand and foot? Does this aid at all in clinging to the tree while climbing? 7. Do you think the opossum's tail is useful to it or is it a bother? 8. Do you think the opossum could hang by its tail and swing downward to rob the nests of birds below? What do baby opossums do with their tails? 9. What is meant by the phrase "Playing 'possum"?"

QUESTIONS ABOUT CHART 43.

1. Name five different ways in which the animals on this page use their hands or feet. In each case tell how the hand or foot is fitted for its work. 2. What kinds of tails are illustrated here and to what uses are they fitted? 3. Would the horizontal position of the tail of the dolphin and the whale tend to turn the animal from side to side or to raise and lower it? Why is it important that these animals should come to the surface of the water? 4. Name four different kinds of places where these animals live? Point out each picture and name the ocean, continent or country from which the animal comes. 5. Why should these forms get their living in so many different kinds of places? What kept them out of other places or prevented their existence there if they ever tried to live in those places? 6. Which is the largest animal on this chart and which the smallest? 7. Which

of these animals is the most intelligent and which the least? How would you go about it to catch each one? Which one do you think is best protected by nature? 8. What things useful to man do these animals furnish? Tell something about these articles, their preparation or their use.

H. B. S.

44. MONKEYS—DOMESTIC ANIMALS.

Here are illustrated a few remaining types which deserve mention either because of their commercial importance to man or because of their scientific relationship to him. The cat and the dog are members of the group *Feræ*; the horse, the cow and the sheep, of the group *Ungulata*; while the monkeys and apes and man are *Primates*.

There is a noticeable difference between the baboon, the rhesus monkey and the chimpanzee, particularly in the presence or absence of the tail. An ape is generally distinguished by the absence of the tail and the more or less man-like form of the body. The hands and feet are very similar to ours and the form of the skull and the resultant expression is more nearly human than that of the monkey. This does not mean in any sense that there is any direct relationship between man and a monkey or between man and an ape. Without going into too great detail as to the origin of things one might say that much of the similarity between man and the ape is due to somewhat similar habits of life. An animal which walks upon only two feet must needs have a good foot, the body should be balanced almost directly over the supporting feet, the hands should be fitted for grasping objects, unless it be used for flight, and the head should be almost balanced, that is to say the face should not project forward so much that it is not easily held up. The chin, then, would be shortened and the hinder portion of the skull more full and possibly the upper part of the

skull more rounded than is the case with most other animals.

The teacher who has followed the development of the animal types through these pages will comprehend how the structure of man and the monkey eminently fits them for success. When one appreciates what man owes to the skill and cunning of his hand he will realize that its possession is probably man's greatest structural advantage. In addition to this man has developed not only an articulate speech but written characters and signs for expressing the thoughts of his mind. Last and best of all is the possession of a large brain capable of acquiring the greatest skill in developing the highest phases of the instincts which many other animals have, such as love, hatred, fear, anger and play, and of formulating great thoughts by means of memory, imagination, will, reason and reverence.

No scientist, even the most rabid evolutionist, claims that man is descended from the modern monkey; many evolutionists, however, do believe that monkeys of today and man had a common ancestor in times long gone. Whether or not we all believe the same things, in the end it makes little difference, but most of us are curious to know what the rest of us think. Such eagerness to learn does not imply anxiety to believe, it is merely an outward sign of a hungry mind which, if satisfied, will probably be a growing mind and not a dwarfed one.

CHIMPANZEE.

The Chimpanzee is the most man-like of all the apes for it is capable of considerable mental training, such as being taught to count and to go through certain simple physical and mental exercises. In walking the chimpanzee's foot is placed flat upon the ground, the body leans forward and is partially supported by the arms, for the fingers are bent and the animal rests as it were upon its knuckles; it is noticeable that the legs are comparatively short and that the arms are long. The animal is

not strictly a walking type, for it lives at least part of the time in the trees. The big toe is placed far back at the side of the foot, giving to the foot some power of grasping, an arrangement which is very valuable for an arboreal animal. The chimpanzee is at home in the forest regions of central Africa but it is rather common in traveling shows and menageries for exhibition. The chimpanzee of the Plate is "Bess," one of the most celebrated educated chimpanzees. She was dressed in human clothing and made to perform simple exercises such as using a knife and fork, making her toilet with the use of a mirror and comb, counting straws or blocks, etc.

BABOON.

The Baboon is an African animal, living throughout the continent in rocky and more or less open districts. Baboons frequently live in large numbers in the neighborhood of plantations, robbing granaries, gardens and fields. They display remarkable cunning in these thieving expeditions for they always post a sentinel high in a treetop while the marauders themselves seize the slightest opportunity to make their raids. The settlers detest them and yet have considerable respect for their cunning. They are good acrobats and fierce fighters, for with their strong canine teeth they are a dangerous foe.

RHESUS MONKEY.

The Rhesus Monkey is the sacred monkey of India, where it is regarded with high honor. The natives in mountainous districts and hilly country regularly leave one-tenth of their crops in the fields for these monkeys, and the monkeys come in large bands and collect their tribute. Because of the reverence with which they are held they have become bold thieves, not hesitating to enter houses to despoil anything at hand. They are usually a little less than two feet in length, with the tail one-half as long again.

HORSE.

Before undertaking a close study of the illustration it would be well for the teacher to retell to his classes the story of the development of the modern Horse in ancient times. A great many thousand years ago there lived in the western part of North America, in what is now Wyoming, a small animal hardly as large as a fox. It had a long face with many teeth for eating vegetation, bushy tail, short hair on its body, and hair down the back of its neck. This primitive horse had five toes on each foot. Through succeeding centuries the animal gradually increased in size, in length of limb and in speed; the teeth became fewer in number but better developed for grinding; and the toes gradually decreased to four, to three and finally to one. When the animal had attained the size of the modern pony it disappeared from North America, doubtless because of conditions of climate or food supply, but it had made its way across reaches of land which connected Asia and America; it persisted in southern Asia. In consequence the modern horse reached its highest development in Europe, Asia and Africa, and came to live in America only when it was brought over by the early discoverers and colonists in modern times. Conditions here were again so favorable, however, that it soon adapted itself to a wild life on the plains; there it has come to be called *Indian pony* and *mustang*. Asiatic forms long ago became specialized or branched off to form the African zebra, the ass, the Shetland pony, the wild pony of Thibet and the Arabian horse. By intelligent, careful breeding man has developed within the last thousand years those varieties with which we are all more or less familiar. Besides the ponies there are the heavy draft horses such as the Percheron and the Shire, the lighter but enduring coach or carriage types and the lightest but the most speedy of all, the thoroughbreds and trotters. For a detailed study of these types the teacher should refer to such books as "Types and Breeds of Farm Animals," by C. S. Plumb (Ginn & Company, \$2.40).

THOROUGHBRED.

The form illustrated on Chart 44 is a Thoroughbred, a form which was developed in the United States and Great Britain about two hundred years ago. It is distinguished by the fine head and muzzle, the prominent and delicate ears, the rather small chest, the long and rather full hind quarters; the legs themselves are rather slender and clean in outline. Such a horse as this would probably weigh about one thousand pounds. The highest price recorded for a horse of this type is \$187,500, which was paid for the stallion, Flying Fox, in England in 1904. The highest amount of winnings recorded by Mr. Plumb is \$249,502; and the fastest recorded time is $1.35\frac{1}{2}$ for a straightaway mile. It would be well for the teacher to sketch on the board the outline of a horse and to name upon it the various points in external structure. Perhaps the most accessible source of information for this exercise is the diagram of a cow in the Farmers' Bulletin No. 106 of the United States Department of Agriculture; this bulletin is particularly apt in the study of the cow shown on this same Chart of the Study.

QUESTIONS.

1. What experience have you had with a horse or pony? What was the horse's name? What color was it? For what was the horse used; for driving, for hauling heavy loads, or for the saddle?
2. What do horses eat? Is the horse's neck and head long enough to reach to the ground in feeding or must it eat from a manger or a feed box?
3. How fast can horses run?
4. How many toes has the horse? Where is the horse's toe nail? Does it hurt the foot to trim the hoof? What is the frog of the horse's foot?
5. What kind of teeth has the horse? When the bridle is put on the horse's head where in the mouth does the bit lie?
6. How much do horses weigh?
7. What various colors may horses have? Do their colors change with the season? Do their coats of hair change with the season?
8. Do horses get sick? What

sicknesses do they have and how should they be treated? How should a horse be cared for in winter; in summer? 9. Name some of the parts of the harness and tell or show how a harness should be put on. How heavy a load can a team of horses haul? 10. What signs of intelligence do horses show? Have they a memory, will, affection, anger, fear, jealousy? Are all horses alike in disposition? Tell some stories which you may have heard or read about the value or intelligence of horses. 11. What care does the mother horse take of the colt? When a colt is born is it able to stand and walk, like a young chicken, or is it helpless, like a young robin or baby? 12. Name and describe some of the different ways in which horses travel, as galloping, trotting and pacing.

Cow.

The Cow was developed in prehistoric times from the wild cattle of Europe and Asia. As in the case of the horse there have arisen many distinct varieties, though only two distinct types, namely the beef and the dairy. The former is a large, square built, heavy form; the latter a more angular, less beefy and better producer of milk. The illustration is apparently of a Guernsey cow, one of the dairy forms. This particular picture does not show the highest points of dairy excellence, yet without the milk record one should not pass judgment upon the cow too severely.

Almost every state department of agriculture will be glad to furnish schools with bulletins and pamphlets having to do with dairy questions and while this manual does not aim to specialize upon any one topic yet we may state a few points which the teacher could use in discussing this illustration with his class. The outline of the cow along the back is almost straight from the crown of the head to the base of the tail. In the beef type the lower line of the body is more or less parallel with this line but in the dairy type it is so slanting that if both lines were continued forward they would meet not far from the head, thus forming a V. When seen from above the

cow is widest at the hips and pointed at the head, forming a second V. When seen from behind, the body is broad above but narrow toward the feet, thus forming a third V. As a general rule the dairy cow closest approaching perfection in these three V's ranks the highest in excellence of outline; the beef type is more rectangular in outline. The expression of the face is a very good index of the disposition and milk production, for a wild nervous creature will spend her energies in roaming or fence jumping, while a creature of mild and contented character will afford more time for browsing and the production of milk. The quantity of milk produced, while of great importance, is minor to the milk quality. There is no way of determining the work of a cow by mere guess or conjecture. The total yield of butter fat for a period of time and the total cost of feed should be carefully accounted against each cow of the herd. Liberty is taken here of quoting a school bulletin of the Agricultural College of the University of Illinois:

THE STORY OF GOLD AND GILT.

"At the Agricultural Experiment Station are two cows, the story of whose work is well worth telling. They were brought up alike on a farm near Elgin, Ill., and obtained their early education in the same herd of 100 cows. Here at the University, with the very same surroundings and equal opportunities, they have drifted far apart in character, and their progress has been in opposite directions. It is not a difference of hide, or horns, or temper; it is not that one is wild and the other a pet. It is not a difference of beauty or intelligence, but solely a difference in the way they have worked, a difference in the money they have earned for the owner.

"All the milk of these cows has been weighed and tested for three years. A record has been kept of every pound of feed consumed by each animal, both summer and winter.

"Each year Gold produced on the average 11,390 pounds of milk containing 405 pounds of butter fat, but

during the same time, Gilt averaged only 3,830 pounds of milk with 138 pounds of butter fat.

"These cows were both cared for in the same way; they were given the same kinds of feed and allowed to eat all they wanted. Gold ate one-half more than Gilt, but produced nearly three times as much milk.

"Equal amounts of feed made in the one case 199 pounds of butter fat, and in the other, 100 pounds. The one cow produced nearly twice as much as the other from exactly the same feed in kind and amount.

"Counting the butter fat at 23 cents per pound, and taking out the exact cost of feed in each case, the one cow brought in a profit of \$34.59, while the other lacked \$5.62 of paying for her board at market prices of feed, each year.

"This comparison, exact and complete for three years and including the record of both milk and feed, means a great deal more than a single year's comparison or one in which it is necessary to introduce an estimate.

"1. What is the difference between Gold and Gilt in production of butter fat?

"2. What is the difference between these two cows in profit to the dairyman?

"3. How many cows like Gilt would the dairyman have to keep to bring him as much profit as one cow like Gold?

"4. One pound of butter fat will make 1 1-6 pounds of butter. How many pounds of butter did Gold produce each year?"

In certain districts of the West the dairying industry is replaced by grazing and the entire treatment of the Chart illustration should be taken from a different point of view.

QUESTIONS.

1. What are some of the various breeds of cattle and for what purposes are they raised? How do you distinguish them? Which is the best kind of dairy cow and which the best kind of beef cow? 2. What are some of

the states especially interested in dairying and which ones raise the most cattle for beef? About what is the average price of beef in the meat market? How much is a good dairy cow worth? 3. What use does a cow make of her horns, of her tail? Do the horns increase in size each year? Are they cast off like those of a deer or do they keep on growing? Do you know of any way of telling the age of a cow by her horns? 4. Are the horns in front or behind the ears? Can you think of any good reason for their situation? 5. How does a cow eat? What is she doing when chewing her cud? Do you know anything about the peculiar arrangement of the cow's stomachs? What kind of garden vegetables does the cow like? 6. Upon how many toes does the cow walk? What are the dew claws? Can you think of any reason why the cow can not run as fast as a horse? 7. What kind of noises do cows make? For what purpose do they make these noises? 8. What do you know about the mother cow's affection for her calf? about the calf's affection for its mother? At what season of the year are calves usually born? How many of them constitute a family? 9. What are some of the names frequently given to pet cows? About how much milk does a cow usually give? How often should a cow be milked? 10. What are some of the things made from cow's milk? At what prices do such articles usually sell? 11. In what countries are cattle raised? In other countries what animal takes the place of the cow? 12. Why are some cows profitable and others not? How would you keep a record of a cow in order to determine whether or not she was worth keeping? 13. Which are more active, cattle or horses? Which eat more? Which should have the more nutritious food? Which animal needs the more shady pasture? 14. Why are rivers and brooks valuable where cattle are raised? 15. What is the general expression of the cow's face? When a cow is included in a picture does it seem to make the picture more peaceful or more wild?

THE SHEEP.

The Sheep are domesticated forms of the wild sheep which in prehistoric times roamed throughout mountainous and hilly country the world over. Because of their docility and the excellence of their flesh and the great usefulness of their wool they were soon domesticated and almost the earliest industry of man of which we have any record is that of sheep raising. From many of the shepherd people there have come to us many great poems and the beginnings of such sciences as astronomy and mathematics.

As in the case of the cow we have two very distinct types of sheep, the mutton and the wool. In the first, breeding has brought about a heavy, more or less square built form which matures quickly; examples of it are the South-down and other "Downs," and the Shropshire. The wool type is more apt to be of long neck and leg and a greater angularity throughout, much after the fashion of the dairy cow, while a greater surface of skin and a greater amount of wool is indicated by the heavy foldings of the skin, particularly about the neck; examples of this type are the Merino and the Rambouillet. As in the case of the cow, bulletins covering various phases of sheep industries may be obtained from the United States Department of Agriculture and from the various state agricultural stations.

Certain points in connection with the study of sheep are worthy of mention. In the wool type the more folds there are in the skin and the more crimping in the wool the finer will be the fiber, or "staple." The wool should be at least 1-5 of the total live weight of the sheep; those sheep weighing about one hundred pounds should yield a fleece of about twenty pounds. The mutton type is heavy and square built, the neck rather short and level with the body, the legs slender and clean from the body down. In connection with the sheep the subject of the angora and other goats may be touched upon.

QUESTIONS.

1. In what kinds of regions do sheep thrive best, cold countries or warm countries? Why? 2. What name is given to a large number of sheep and the man who takes care of them? Why should the dog be included in the picture of the sheep? What do you know of the intelligence and training of such dogs? How many sheep are in a flock? 3. Do you think the sheep in picture are raised for their wool or for the meat? What reasons have you for thinking so? 4. What do sheep eat? How close do they crop the grass? Do they like to live in grassy meadows or in rough hilly country? 5. What are their habits about following a leader? Why does the farmer frequently hang a bell on a certain sheep's neck? 6. What do you know about lambs? When are they born? How many are there? 7. Does the lamb have a tail? Does the sheep have a tail? What becomes of the lamb's tail? 8. Why do some sheep have horns? 9. How much wool does a sheep yield in a year? Why are sheep washed? After clipping off the wool does the sheep grow a new coat? At what season of the year are sheep sheared? What uses are made of wool? Name several articles made from it. 10. Is the skin of the sheep good for anything? If so, tell all you can about it. What parts of the sheep's body are used for food? How does a sheep compare in price with a cow or a horse? 11. Tell any experience you may have had with pet lambs.

THE DOG.

In the description of the fox and the wolf on a previous page, the general characteristics of the dog group were given, namely, the distinct bushiness of the tail, the elongation of the head, and the toe-nails which are not retractile. On chart 44, the Irish setter is truest to the dog type while the pointer illustrates what man has done by careful breeding, in this case, producing an animal with short, smooth hair. There are recognized about one hundred and eighty distinct breeds of domesticated dogs which are scattered throughout the world among all people.

Some seven distinct types of wild dogs occur, or have recently existed, in almost as many different parts of the globe. The domestic forms have probably been developed from various original types, for it would hardly have been possible for man to secure the many widely different breeds now existing from any single one of the original types. That man has regarded the dog either as a friend or as a servant from the most remote times is proven by the remains of dogs found in ancient sites of primitive man in Denmark, Germany, England, the lake dwellings of Switzerland, and in the cave remains in the mountains of France and Belgium. In one case the skeleton of a dog was found buried with that of a woman.

Among the present forms may be mentioned a few of the extreme cases: the hairless dogs of Mexico and Cuba and the heavy-coated one, of the far north; the tiny lap-dogs of Japan, whose weight often does not exceed one and one-half pounds, and the large forms which have been bred for special work, such as the Saint Bernard, the Newfoundland, and the mastiff. In Belgium dogs are harnessed to small carts by street peddlers and made to serve as beasts of burden. In far northern countries where reindeer are not used, dog teams furnish the only means of transportation over long distances. In Scotland the shepherd often prizes his faithful friend more highly than his own son. An instance of this is well told in the story, "Bob, Son of Battle." In Mexico the primitive Indians in certain districts regard as sacred a certain breed, the Chihuahua, which is a small form averaging in weight from one to three pounds, of reddish color, almost hairless, and which is characterized by great sensitiveness and high intelligence. The Bushman of Australia has partially tamed the wild dog of the region, the dingo, using it largely as a means of protection about his home.

The two dogs pictured here in the Study are quite similar in habit and size; both are used in hunting, but the setter is the more sensitive of the two, the more responsive to kindness and house treatment. The pointer and the

setter, as almost any boy or girl will say, are usually trained by hunters to assume a rigid position the moment game is sighted, often stopping in the very act of making a step; such a position is illustrated. The domestic dog is subject to many of the ailments of man but is immune to others, and is subject to diseases of his own. Because most of these diseases are contagious, a sick dog should be carefully tended and either nursed back to health or, as painlessly as possible, put out of his misery. A boy who is allowed to treat dogs and cats with cruelty will as a man usually have no compunction in inflicting pain upon his fellow men. Therefore children should be taught kindness to animals, not only because of their relations to the community without, but also because the greatest reaction from any habit is upon the individual himself. The teacher can borrow a dog for a portion of a day, and with it as a living example and the picture at hand for longer continued work, can develop a very interesting and profitable lesson in nature study. The following are among the topics which may be discussed to greater or less length:

1. The kinds of dogs possessed by members of the class, their colors, sizes, and particular uses.
2. How dogs should be fed and how their food affects their dispositions. The kinds of teeth dogs have and what each is used for. Peculiar structures on the tongue and their use.
3. Dogs; their good and bad habits.
4. How to train dogs to perform tricks.
5. Some of the various sicknesses which dogs may contract and how each of these should be treated.
6. The length of life of the dog.
7. Some of the remarkable doings of dogs that the children know or may have heard about.
8. The number of puppies dogs have. Puppy habits.

The teacher would do well to read aloud or to put into circulation in the class some of the good dog stories; as, "Rab and His Friends" by John Brown, and "Beautiful Joe," by Marshall Saunders.

CATS.

The domestic Cat, while a comparatively popular animal at present time, has enjoyed man's protection for relatively only a short time. It is definitely known that the Egyptians made a pet of this animal a long time ago, for it is pictured in ancient carvings, but it was only a few centuries ago that the cat was imported into northern and western Europe where, for a long time, it was kept only by kings and princes. That it was not a common animal is indicated by the high esteem and reverence given to it in such stories as that of "Dick Worthington" and "Puss in Boots." As in the case of the dog, it is probably true that some of the breeds of domestic cats are developed from unlike types of the many wild forms. Among the domestic forms may be mentioned the maltese, tiger, the angora, and the Manx cat.

The disposition of the cat, while such as easily to render it domestic, still keeps it without the pale of man's close friendship; it may submit to a certain amount of attention and care, yet sooner or later it will revert to many of its wild, ancestral traits. Thus the hunting instinct will constantly assert itself, and, as well, many sneaking, thieving ways. In spite of all restraint the cat insists upon its nocturnal habits and a much greater amount of freedom to do as it pleases than does the dog. To be sure, there are many exceptions to these rules, but on the whole, the statement will prove true. As indicated in the study of the dog, some cats will submit to becoming the subject of class observation and the teacher will be able to use them for a little while. The questions or topics indicated for the dog may, with some little variation, be used in this case, too.

QUESTIONS.

1. Which animal has the largest ears? Are they erect, or do they hang down? Are they movable or quite stationary?
2. Which animal is the more stealthy in its habits?
3. How are the nails or claws of each protected when not in use?
4. Why is the cat able to walk noise-

lessly on a bare floor while the dog makes a scratching sound? 5. Describe the method used by a cat in catching birds and that used by a dog? 6. Which animal has the sharpest teeth? 7. Which one has the most dependable disposition? 8. Which one is the best able to find its way back to an old home? By what sense do you think it is able to do this? 9. Which is the most subject to diseases? Which is the most likely to bring diseases into a family of children? 10. Which one is best suited to an indoor life? 11. Describe the play of a kitten; of a puppy. 12. What plant, if any, does the dog particularly like; the cat? 13. What emotions does the dog express by means of his tail; the cat? 14. Is the cat's nose moist and cold; the dog's? How does the moisture of the nose affect the ability to smell? How do you account for the moisture of the nose; is it because Noah was compelled to put the dog in the Ark with his nose out or because there are sweat glands on the skin at this point?

H. B. S.

46. DENTITION AND FEET OF VERTEBRATES.

No detailed description of this plate is given here because the structures pictured have already been explained; dentition is described in Chapter III, and the comparative structure of animals' feet is described in Chapter II.

H. B. S.

48. THE BILLS AND FEET OF BIRDS.

The general principles which govern the structure of the mouths and teeth of other animals and of their feet as well are explained in Chapters II and III. Chart 43 is briefly treated in direct connection with the birds; it should, however, be explained as a unit. In Chapter III there is explained the connection between the forms of the teeth, the kinds of food eaten, and the mental traits or disposition of the animals; the principles there brought out were equally true for the birds.

Any pupil will volunteer the information that all birds cannot eat seeds because there are not seeds enough for all the birds. All birds cannot eat fish because there are not fish enough to supply the bird population very long. All birds cannot eat insects for all the insects would soon be eaten and then the birds would starve. It is doubtless the case that a long time ago those birds which, because of some slight advantage in the form or action of their beaks, or abundance of seeds, were able to get more seeds than others, became, by habit, seed eaters; gradually their particular form of beak has become more and more marked. Those which ate flesh because they could do this most easily have become flesh eaters and now would starve on any other diet. Thus there have arisen the peculiar beaks illustrated at the left of Chart 48. Those birds which are accustomed to subsist on flesh have their beaks thick, heavy and strong, and hooked at the end. In that highly entertaining story for boys and girls called "Citizen Bird," the authors have made use of certain terms which any teacher will do well to appropriate. The success attending their use will far more than justify the slight trouble expended in explaining them. Though it is far from being complete, a very adaptable table of the birds arranged according to their traits has been formulated from "Citizen Bird" as follows:

KIND OR CLASS	TRADE	EXAMPLES
Runners		Ostrich, Emu and Rhea
Divers	Bottom searchers...	Loon and Grebe
Flat-billed swimmers....	Surface skimmers...	Ducks, Geese and Swans
Long-winged swimmers..	Tireless fishers.....	Gull and Tern
Beach runners.....	Mud probers	Rail, Sandpiper
Waders.....	Frog stabbers.....	Crane, Heron
Scratchers.....	Ground gleaners...	Partridge, Pheasant, Bob-white, Turkey and Chicken
Robbers.....	Silent watchers....	Eagle, Hawk and Owl
Climbers.....	Tree tappers.....	Woodpecker and Sapsucker
	Weed warriors	Sparrow and Finch
	Seed sowers.....	Thrush, Robin, Waxwing and Blackbird
Perchers (song birds)..	Leaf explorers	Warbler and Vireo
	Sky sweepers	Flycatcher, Swallow, Martin and Nighthawk

By the use of a simple classification such as the foregoing, in which the birds are listed by trades, classes almost unconsciously come to understand bird life and bird ways, and even to add forms of bill and foot to those pictured on Chart 48.

In "Bird Life" Mr. Chapman points out the fact which has already been stated in the Manual in connection with the bat, that when the arm and hand come to be used for a special purpose they become correspondingly useless for other things. In case of the bird the bill has undertaken to do the things which one would expect the hand to do. "In constructing the nest the bill may be used as a trowel, an auger, a needle, a chisel, and several other tools. But as a hand the bill's most important office is that of procuring food; and wonderful indeed are the forms it assumes to supply the appetites of birds which may require a drop of nectar or a tiny insect from the heart of a flower, a snake from the marsh, a

clam or mussel from the ocean's beach, or a fish from its waters. The bill, therefore, becomes a forceps, lever, chisel, hook, hammer, awl, probe, spoon, spear, sieve, net, and knife—in short, there is almost no limit to its shape and uses."

The strong hook at the end of the bills of the albatross, the bald eagle, and the parrot indicates its use as a pincher. That of the albatross is too long for great strength in catching or lifting heavy objects; that of the eagle is well adapted for such lifting or attack; in the parrot, the movableness of the upper mandible indicates considerable loss of strength but gain in general usefulness.

The albatross has its beak sufficiently elongated that it may be thrust some distance into the water without the head's being immersed and long enough that the captive fish may be tossed up and caught lengthwise in the beak without danger of its escape. The lowermost picture in this column, that of the pelican, is very similar and indicates a habit much like that of the albatross. The bald eagle, however, apparently feeds upon other and larger forms than do either of the others.

The beak of the parrot is used as an aid in climbing; it opens very wide, since both mandibles are movable; the bird is fitted to feed upon soft food and to hull seeds. The beak of the crow, like that of the albatross and of several other forms, is elongated so that the food can be obtained at some slight distance from the face. In this case the diet may consist of young roots or germinating seeds close beneath the surface of the ground, though the crow does not disdain other things, even carrion, being an omnivorous feeder. The crossbill with its pair of shears is well fitted to remove from pine cones the seeds there concealed and to shear from them the papery wing with which nature has provided them for dispersal upon the wind. The hummingbird apparently seeks its food in some long narrow tube, not where any great strength of bill is needed for its procurement. This delicate beak is not a digger and naturally adapts itself to the form of many flowers, such as the honeysuckle.

The beak of the spoonbill is eminently a skimmer, adapted to collect food material from the surface of the water and, being sensitive, to select submerged food as it is swung from side to side.

The merganser, one of the fishing ducks, swims below the surface of the water in pursuit of its prey, and to safely hold its captive has developed saw-teeth on the edges of its long narrow mandibles.

The shearwater gained its name from its habit of flying low with its lower mandible thrust into the water as a scoop; for this use the lower mandible is projected far beyond the upper. Its efficiency in a school of fish can readily be imagined. The lower mandible is rapidly worn away by the water. When kept in captivity this great bill soon grows to an astonishing length.

The illustration of the woodpecker's beak and tongue can well be improved by the teacher if he draw upon the blackboard the entire head of the woodpecker, elongating the jaws but leaving them slightly separated. Sketch in the tongue, making it extend through a slit in the lower mandible backward to the base of the beak, then upward and forward around the eye to the base of the upper mandible. After the woodpecker has drilled a hole in the tree the tongue is uncoiled and thrust forward down the burrow of some boring beetle larva until it penetrates the grub there concealed. This juicy morsel, impaled upon the barbs at the end of the tongue, is withdrawn into the woodpecker's mouth. It is needless to say that the tongue at its base is forked so that in turning within the skull a portion of it passes to either side.

The whip-poor-will has its beak reduced so much that it is practically useless save as a shearing organ; it may serve to clip gauzy wings from the body of an insect. The open mouth of the whip-poor-will is enormous; around it hairs radiate, forming a funnel-shaped basket within which insects on the wing are easily caught. The teacher might give a graphic illustration of it and its use by rolling a piece of paper into a very wide funnel.

Having now explained some of the various commoner

forms of beaks the teacher would do well rapidly to turn over the first pages of the Study asking various members of the class to notice the forms of beak various birds have and to make a scientific guess regarding the birds' feeding habits. A very interesting exercise in drawing is provided by Chart 48; have the children copy the figures.

Just as the beaks of birds betray their feeding habits, so do their feet indicate their homes. A leg and foot as short and heavy as that of the eagle with nails as strong and hooked could only belong to a large bird which is accustomed to snatch things of considerable size, lifting them from the ground and tearing them to pieces by main strength. The foot of the owl, with its extensible or prehensile claws, is well fitted for similar work, while the dense feathering of the leg indicates a home amid cold surroundings.

The leg of the pigeon serves well to bring out the peculiar arrangement of the tendons in the leg of any bird. Almost any boy knows that when the pigeon's or chicken's leg is extended the toes are automatically outstretched and when the leg is drawn up or the body settles upon it the tendons are shortened and the toes are drawn inward. Hence it is that in walking, as the foot is lifted from the ground for the forward step, the toes are drawn inward out of the way and hence it is, too, that as the bird settles upon the tree for its night's sleep the toes encircle the limb and cling there without any muscular effort so that the bird sleeps safe from all danger of falling. This is one of the most wonderful provisions in all nature for an animal's safety and welfare.

A perching bird, such as the pigeon, must have the fourth or hind toe well down upon the foot, while a walking and scratching bird, like the bobwhite, must have the toe farther up on the leg and out of the way. Here this toe becomes more useless so that it tends to disappear. The final stages of its disappearance are illustrated in the lower pictures, the feet of various swimmers.

The bobwhite is an excellent example of that group called in the table "Ground Gleaners"; the legs and toes

are strong for scratching; the domestic fowl illustrates the same order. The foot of the woodpecker has two toes projecting forward and two backward in order that the possessor may cling to the vertical trunk of a tree, a position aided by the stiff tail-feathers which are used as props. The whip-poor-will, resting by day lengthwise upon the horizontal branch of a tree, has need of at least one strong claw which will unerringly cling to the bark. In the coot the foot is sufficiently webbed that swimming is fairly easy and fast while it is not so fully developed that the bird is unable to hunt about in the tall grasses where a perfect web between the toes would not only be an inconvenience but would be in great danger of tearing. This foot can swim, can walk, and will uphold the bird upon mud so soft that slender toes would sink in to an inconvenient or fatal depth.

The remaining feet, those of the loon, the duck and the cormorant, show various extents of webbing from where the hind toe is entirely free, to that where the webbing extends beyond the side toe, and to that where it has reached the hind toe.

The diagrams here given do not illustrate the various positions the feet may occupy upon the body. In some birds they are placed well forward so that the body is balanced. In other forms, as the ducks, they are placed so far to the side of the body that upon land the bird "waddles" and so far back that it overbalances and is nearly helpless; but in such cases nature has placed them where man has put the propeller of a boat or the driving gear of an engine, well back under the body. If a body can be supported and steered, propulsion is best accomplished from the rear.

H. B. S.

49. TOPOGRAPHY OF BIRDS—MORPHOLOGY OF ARTHROPODA.

This Chart illustrates those points in the external form of some of the common animals which should be understood in part by pupils of higher classes. There is so much, however, that in most cases the teacher would make a very great mistake to explain it all to a class.

BIRD.

In the figure of the Bird about the only points which the teacher really should know and remember are the following:

The feathers of the wing, primary, secondary and covert; the tail and the tail coverts; the breast, the throat, the forehead, the crown, the nap or cervex, and the back. Almost all of the other terms used on the diagram of the bird will be found only in very detailed descriptions of closely allied forms. The child should not be bothered with them.

CRAYFISH.

The Crayfish is a member of the large group of jointed-legged animals, *Arthropoda*, and of a subdivision of this group, *Crustacea*, which is characterized by the possession of a rather hard shell. Relatives of the crayfish are crabs, lobsters, shrimps, and a host of small forms often seen in standing water. It is to be regretted that the Study does not contain a characteristic picture of the crayfish instead of the diagram here given, for it affords one of the most interesting lessons in nature study and is perhaps more frequently brought into the school room by the children than any other single animal. Crayfishes are easy to keep in pans of water and can be placed on the table top where they will walk about for a considerable time. They have been called "fishes" just as many other creatures have been, because they live in water;

the first syllable of the word crayfish is derived from an old form which meant "crevice"; hence the boy's crawfish used to be a "crevice fish." A study of the diagram or of the living animal will show the division of the body into two distinct parts, a jointed abdomen and a more or less solid front portion which has been formed by the fusion of the true head and the thorax, or "chest"; on the upper side the line of junction, or groove, is very noticeable about midway between the front end and the abdomen. The head bears a long pair and a short pair of feelers, eyes upon stalks, and, below, a complicated series of mouth parts called on the diagram "foot jaws." The thorax proper supports on the under side five pairs of legs, the first of which have become large claws. The abdomen is very muscular and flexible, and bears several pairs of swimmerets, or swimming feet; it terminates in a broad paddle, or caudal fin. If the teacher is so inclined he may make a very extended study of the crayfish and those allied forms of economic importance, as the lobster, the crab, and the shrimp; but in younger classes probably no work will be done other than that based upon the crayfish alone.

A few of the very many interesting topics in this connection are: How does the crawfish walk, how does it swim, and how does it turn over? What is each pair of feelers used for, feeling, tasting or smelling? How do the eyes act? Are there eyelids, eyelashes and tears? How does the crayfish eat? How does it find its food? Why does it push its tail under a stone and sit with its large claws out? Why is the color in front unlike that farther back? How does the crayfish protect himself from enemies, from drouth, from frost in winter time? How does the mother crayfish care for her family? How many baby crayfishes are there and at what season do they appear? Are crayfishes good to eat; if so, what part of the body is used and how is it prepared? What is meant by traveling "crab fashion"? When the crayfish is held by its claw, how can it release itself? Can the lost claw be grown again?

JUNE BUG.

This series of diagrams is intended to show the stages in the development of certain young insects after they hatch from the egg. While some forms, such as the grasshopper, the cricket, and the dragon fly, very closely resemble the parent immediately upon hatching, practically the only difference being that the wings have not grown, the young of many other insects are worm-like creatures called caterpillars, grubs, cut worms, or maggots. In the latter case it is evident that great changes must occur in order that the first stage, called *larva*, may reach maturity. These may require a considerable period of time for development and they necessitate a very great quantity of food; hence it is that such forms are prodigious eaters, and that they are in many cases great pests in orchards, gardens, and fields. Their destruction is accomplished most readily by spraying upon the food plant some poisonous material which the larva will eat. This subject is too extensive to be entered upon in connection with Chart 49. It is probably best that the teacher merely explain to the class that the larva is the active feeding stage; the pupa, the resting stage in which the wings are developing, the head and chest regions becoming relatively larger at the expense of the abdomen; while the mature insect, *imago*, or adult, is the final, egg-laying form. More extensive description of certain beetles is given in connection with Chart 37.

SPIDER.

In the subdivisions of the body the Spider is very similar to the crayfish; there is some reason to believe that a very long time ago spiders and crawfishes developed from a form called the Trilobite. The body of the spider is divided into two portions, the head and chest forming one piece and the abdomen the other. The head bears the jaws, the maxillary feelers, and the eyes; the thorax, or "chest," bears four pairs of legs; and the abdomen, the spinnerets. The group to which the spider belongs contains also the scorpion, the harvestman or "grand-

daddy-long-legs" and the mites and ticks, all of which are in structure quite similar to the spider.

If the teacher should be able to overcome his natural aversion to this interesting creature and should make it an object of study, either privately or with the class, he would find the spider an excellent and profitable subject. Most of our common spiders can be handled without fear of bite or sting and can be observed at close quarters. The eyes, usually eight in number, are very simple and so advantageously placed that they see what is going on in almost every direction. They are quite short-sighted, getting distinct images of things within a distance of less than ten feet; beyond that they realize only blurs and shadows. The feelers are used mostly in manipulating the food while the jaws on the under side of the head crush it in order that the liquid portions or juices may be sucked up. Upon the jaws appear movable fangs which pierce troublesome captives and through which a poisonous fluid is injected into their bodies. This fluid in most cases is no more dangerous to man than is the saliva of a mosquito or a pinch-bug.

Some of the interesting topics in spider study are these: How large and of what color is the specimen? Upon what plant or in what kind of a place does it live? Is its web wheel-like, triangular, a canopy in the grass, or a tangle in the corner of a porch? Is this web a snare for catching food, a home within which the spider lives, or a nest for the raising of a family? What do spiders eat? How do they eat and how do they keep the captured food from tearing the web to pieces? Describe the position, number, and action of the spinning organs. How do mother spiders care for the young?

For careful work upon spiders the teacher should secure some good zoology such as that of Linville and Kelly (Ginn & Co.), or the "Spider Book" by Comstock (Doubleday, Page & Co.), but for more popular work to the author's knowledge the best little book is "The Spinner Family," by Patterson (McClurg & Co.).

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